Capital Regional District

625 Fisgard St.,
Victoria, BC V8W 1R7

Notice of Meeting and Meeting Agenda
Core Area Liquid Waste Management Committee

Wednesday, October 12, 2022 | **9:30 AM** | **6th Floor Boardroom, 625 Fisgard Street, Victoria, BC V8W 1R7**

Special Meeting

D. Blackwell (Chair), L. Seaton (Vice-Chair), S. Brice, B. Desjardins, F. Haynes, L. Helps, B. Isitt, J. Loveday, R. Martin, R. Mersereau, K. Murdoch, C. Plant, D. Screech, N. Taylor, G. Young

The Capital Regional District strives to be a place where inclusion is paramount and all people are treated with dignity. We pledge to make our meetings a place where all feel welcome and respected.

1. Territorial Acknowledgement

2. Approval of Agenda

3. Presentations/Delegations

The public are welcome to attend CRD Board meetings in-person.

Delegations will have the option to participate electronically. Please complete the online application at www.crd.bc.ca/address no later than 4:30 pm two days before the meeting and staff will respond with details.

Alternatively, you may email your comments on an agenda item to the CRD Board at crdboard@crd.bc.ca.

4. Special Meeting Matters

4.1. 22-599 McLoughlin Point Wastewater Treatment Plant - Performance Period Closeout

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: McLoughlin Point Wastewater Treatment Plan - Performance Peric

4.2. 22-227 Wastewater Treatment Project (WTP) Final Funding and Financing Strategy Performance

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: WTP Final Funding & Financing Strategy Performance

Appendix A: WTP Financing Strategy Report Jan. 2019

Appendix B: Project Completion Report May 2016-May 2021

4.3. 22-573 Core Area Inflow & Infiltration Program - 2022 Summary

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: Core Area Inflow & Infiltration Program - 2022 Summary

Appendix A: Core Area I&I Program - 2022 Report (October 2022)

Appendix B: Map Summarizing I&I in the CRD's Core Area

Appendix C: Table Measured Flows to Allocated Flows (Bylaw 4304)

5. Adjournment

This is the last scheduled meeting for 2022.

To ensure quorum, please advise Jessica Dorman (jdorman@crd.bc.ca) if you or your alternate cannot attend.

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REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE
MEETING OF WEDNESDAY, OCTOBER 12, 2022

SUBJECT **McLoughlin Point Wastewater Treatment Plant – Performance Period Closeout**

ISSUE SUMMARY

The McLoughlin Point Wastewater Treatment Plant (MPWWTP) performance period will end on January 13, 2023 and under the terms and conditions of the MPWWTP Project Agreement, staff are preparing to closeout the Performance Period and issue final associated payments and holdbacks.

BACKGROUND

On January 13, 2021, the Capital Regional District (CRD) accepted operational responsibility for the McLoughlin Point Wastewater Treatment Plant (MPWWTP). The commissioning period of the MPWWTP has continued to extend into the two-year performance period for the MPWWTP. As previously reported, during this time, the commissioning activities at the MPWWTP have periodically impacted plant performance and effluent quality, and some plant systems, including odour management. Staff remain confident that the issues identified through the commissioning and performance period will be addressed and that the MPWWTP will achieve performance expectations. Based on the status of the project, operational performance, and terms and conditions of the MPWWTP Project Agreement, staff are preparing to closeout the Performance Period by January 13, 2023.

MPWWTP Acceptance and Performance Testing

As previously reported, Harbour Resource Partners Limited Partnership (HRP) has demonstrated through acceptance testing and independent certification, that the MPWWTP has achieved compliance with the Project Agreement standards with regards to process equipment, mechanical systems and control systems. Subsequent to the formal MPWWTP acceptance, which occurred in October 2021, the MPWWTP achieved the following acceptance tests:

- Wet Weather Event Acceptance: Demonstrating plant performance when influent flow is in excess of 216 MLD for a minimum period (December 2020).
- Seasonal Odour Control Acceptance: Demonstrating odour control system performance during periods of water ambient air temperatures (July 2021) and cold ambient temperatures (January 2021).
- Energy Utilization Acceptance: Demonstrating energy utilization at MPWWTP does not exceed the guaranteed maximum energy utilization, adjusted for flow, loading and temperature conditions.

The two-year Performance Period commenced on January 12, 2021. During the Performance Period, and while the MPWWTP has been under CRD operation, HRP has been required to continuously monitor compliance with the Process Performance Guarantees which include:

- Effluent Guarantee: All effluent will meet the specified effluent quality requirements.
- Maximum Sludge Production Guarantee: Sludge production will not exceed the guaranteed maximum sludge production volume and will meet a primary and secondary sludge solids concentration of 1.5-2.5%.
- Odour Control Guarantee: Odour/hydrogen sulfide emissions will not exceed the specified odour emission limits. Odour complaints will result in an investigation to establish the nature of odour at the reported locations and/or the MPWWTP, which will include a determination of performance of the odour treatment system at the time of the complaint.
- Noise Guarantee: operating noise at he MPWWTP will not exceed the limitations on noise prescribed by Township of Esquimalt noise control bylaws.

Effluent Quality

As reported in July, the MPWWTP is a complex plant that involves complex treatment processes. In most cases a single cause and effect reason is unidentifiable for each non-compliance result, but rather a number of often compounding factors. The critical issues contributing to plant performance and periodic reduced effluent quality are continually being investigated and operational adjustments are being implemented. Through continued treatment process optimization, utilizing process engineering consultants, HRP's performance management personnel, and CRD staff process engineering expertise, the CRD remains confident that the MPWWTP effluent quality criteria will be consistently met at the end of the Performance Period, subject to outcomes of planned optimization efforts over the next three months.

Odour Control

The CRD continues to receive odour complaints, primarily from the West Bay (Township of Esquimalt) and Victoria West (City of Victoria) neighborhoods. CRD staff continue to respond to every complaint and are logging and mapping every complaint to try to correlate the occurrence with operational activities and other potential contributing factors. As reported in July, the CRD continues to take steps to improve the function of the odour treatment system and add equipment to further reduce potential odour causing emissions. As of September, the odour control system is fully functional and operating as per the design specifications during normal operating conditions. However, the CRD continues to monitor the odour control system performance and discharges, and is working directly with equipment suppliers to seek opportunities to further increase potential odour removal.

Due to the nature of the complaints (location, timing, wind direction, operational activities occurring), it is believed that there are other potential sources of odour that may be contributing to the impacts in the neighborhoods, so CRD staff have continued to work with the City of Victoria (COV) staff and HRP to identify other potential sources.

At the end of August, COV conducted smoke testing in the municipal storm drain and sewer collection systems in the Victoria West area. Smoke testing will identify where cross-connections between private property sewers and the municipal storm system exist, and/or where cross-connections between private property drains and the municipal sewer system exist. The testing revealed that there are 16 properties in this area that could have the home/building sewer connected to the COV storm drain system. This means that sewer/waste is likely being discharged from the homes into the municipal storm drain pipes that are 'dry' during the summer months – the waste would accumulate and likely cause significant odour. The 16 cross-connections are on

Hereward Road, Walker Street, Griffiths Street and McCaskill Street. To add to this, this storm drain system discharges through an outfall at Barnard Park into West Bay, which could be causing odour in the West Bay area. This was further confirmed through recent bacteriological testing, which indicated significantly elevated levels of wastewater contamination near the outfall. In addition, the CRD deployed hydrogen sulfide data loggers in two storm drain manholes on Hereward Road during September/October which did confirm elevated levels of hydrogen sulfide in the storm system which indicates wastewater exists in the storm drain system.

There is more investigation work planned, including smoke and dye testing and the CRD will be working with the COV to understand how they plan to address the cross-connections. This will potentially involve the COV working with each homeowner and will take some time. Township of Esquimalt staff will also be included in the on-going investigations due to the interconnectedness of the municipal infrastructure further upstream.

In addition to the above, the following actions related to odour control system improvements and investigations are planned prior to year end:

- Further odour survey work during specific times of day and by boat (between MPWWTP, West Bay and Work Point Marina).
- The MPWWTP odour treatment system was not designed to extract air from the tertiary treatment process tanks. The secondary odour treatment system will be modified to treat this potential source of odour laden air. The system is expected to be operational by November now.
- The CRD will be undertaking an 'audit' of the design and performance of the MPWWTP odour treatment system with the owner's engineer (Stantec). This work will begin in October.
- The CRD has undertaken some initial odour investigation work with Vancouver Island University (VIU), who has done similar work with the Regional District of Nanaimo. With VIU, the CRD is hoping to 'fingerprint' the chemical odour profiles from different sources and associate these profiles with odour present in different locations. This work is expected to occur this Fall.

The CRD acknowledges that the resolution to the odour concerns is taking some time, but the CRD remains committed to achieving the performance criteria set out for the MPWWTP, and assisting the other municipalities in determining other potential odour sources and infrastructure issues. CRD staff did receive a letter from the Township of Esquimalt staff at the end of September, which outlines the outstanding commitments between the Township and the CRD, including odour management; the CRD is preparing a response.

<u>MPWWTP Project Agreement Acceptance and Performance Holdbacks/Payments</u>

As per the Project Agreement, upon receipt of the Acceptance Testing documentation and the relevant Independent Certifiers' Acceptance Test Reports the following Acceptance Payments have been released:

- Acceptance Payment in the amount of $60,000,000 (January 2021)
- Wet Weather Event Acceptance Payment in the amount of $3,000,000 (January 2021)
- Seasonal Odour Control Acceptance Payment in the amount of $2,000,000 (October 2021)

- The remaining Project Agreement holdbacks are as follows:
- Completion Holdback in the amount of $5,000,000 to be released following the Performance Period subject to satisfying the performance protocols defined in the Project Agreement, less an amount equal to 200% of the value of any outstanding warranty work as determined by the CRD.
- Performance Incentive Payment in the amount of $500,000 to be released following the Performance Period subject to continuously achieving compliance with all of the Process Performance Guarantees throughout the Performance Period plus an amount up to $500,000 subject to operations and maintenance cost performance, quality of service provided by HRP during Performance Period, and extent of warranty work performed during the Performance Period.

Completion Holdback

CRD staff continue to work with HRP at the MPWWTP to identify and address equipment and process related issues affecting performance and operation. Since January 2021, there have been 313 warranty or deficiency items identified through on going inspections and operational reviews. HRP has funded approximately $2,900,000 through the Performance Period to replace faulty equipment and consumables and add equipment not included in the original design. It is anticipated that by the end of the Performance Period, all but four of the deficiency and warranty items will be addressed. The estimated value of the outstanding items is up to $70,000. With HRP's agreement, it is proposed to withhold this amount from the final contractual payment in December 2022, until the work is complete. Stantec, the owner's engineer on the project, will provide a recommendation to release the holdback prior to year end, based on an 'inspection report' as per the Project Agreement.

Performance Incentive Payment

In consideration of the process performance guarantees, given some of the challenges related to consistent effluent quality and odour control, but also HRP's cooperation and commitment to a successful project through the Performance Period, the CRD is proposing a performance incentive payment of $800,000.

Latent Defect Warranty

Under the Project Agreement, any defects that become apparent during the Latent Defect Warranty Period, which expires January 12, 2031, which were not identified, and could not reasonably have been identified during the warranty period or before the end of the Performance Period, will potentially be rectified by HRP, subject to the CRD notifying HRP and a review process by HRP and the CRD.

CONCLUSION

Based on the status of the MPWWTP project, operational performance, and terms and conditions of the MPWWTP Project Agreement, staff are preparing to closeout the Performance Period by January 13, 2023. CRD staff have been working with HRP to address final remaining deficiency, warranty and operational issues and proposing to release the Completion Holdback and pay a portion of the Performance Incentive Payment in January. The CRD remains committed to

achieving the performance criteria set out for the MPWWTP beyond the contractual conclusion of the Performance Period.

RECOMMENDATION

There is no recommendation, this report is for information only.

Submitted by:	Ted Robbins, BSc., CTech., General Manager, Integrated Water Services
Concurrence:	Kristen Morley, JD, General Manager, Corporate Services & Corporate Officer
Concurrence:	Nelson Chan, MBA, FCPA, FCMA, Chief Financial Officer
Concurrence:	Robert Lapham, MCIP, RPP, Chief Administrative Officer

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REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE
MEETING OF WEDNESDAY, OCTOBER 12, 2022

SUBJECT **Wastewater Treatment Project (WTP) Final Funding and Financing Strategy Performance**

ISSUE SUMMARY

The Capital Regional District (CRD) is in the closure phase of the Core Area Wastewater Treatment Project (WTP, or the Project). This report provides the final project funding update with evaluation of the financing strategy performance.

BACKGROUND

On January 9, 2019, the CRD Board approved the WTP Financing Strategy, as referenced in Appendix A (Report to the Capital Regional District Board (Jan 9, 2019) Wastewater Treatment Project (WTP) Financing Strategy), which projected cashflow needs to the end of the project, inclusive of grant funding. A strategy was designed to lower overall costs of financing using a combination of funding, including debt during construction. A "staggered incremental long-term debt" strategy was recommended to leverage market conditions, mitigate risk of interest rate fluctuation and minimize short-term financing expenses, while meeting cash flow requirements. This recommendation included advancing $60M long-term debt in the spring of 2019 to leverage low borrowing rates.

On May 19, 2021, the Project Board/Staff reported that the project had reached substantial completion and that the project was delivered on budget and that all funding partner reporting requirements and claim eligibility were optimized and on plan as referenced in Appendix B (Project Completion Report).

In July 2021, the Committee received a report that provided an update on the wastewater system commissioning, operation, and construction completion status. The construction across all the Project components was declared substantially complete. Staff continued to work with the various contractors and consultants to address final construction deficiencies and deliverables.

In October of 2021, the Committee received a report stating that cumulatively, the CRD had received $358.8 million of the estimated total of $462.3 million in eligible grant revenue. The remaining (up to) $103.5 million was expected to be received by the end of the year.

This report provides a final update on project funding and performance of the project financing strategy.

IMPLICATIONS

Financial Implications

The forecast of total cost at project close out is $775.0M. This includes $705.7M in costs expended, $63.0M in future obligation under the Residuals Treatment Facility (RTF) contract and the remaining $6.3M in program reserve. Upon close of the project fund, the program reserve will

be transferred to capital reserve and restricted for future capital investment within the Core Area Wastewater Service.

As planned in the 2016 Business Case, the Wastewater Treatment Project has been funded from a combination of requisition dollars, grant funding and long-term debt. The financing strategy approved in 2019 further planned the optimal timing and use of each source of funding throughout the life of the project. Table 1 below summarizes total funding by partner and compares the total funding at closeout to original business case (2016) and the financing strategy (2019).

Table 1: Plan vs. Actual Wastewater Treatment Project Funding by Partner ($ Millions)

Funding Sources	Business Case (2016)	Financing Strategy (2019)	Total (Close Out)	Difference (2019 vs Close Out)	% Share
Federal Grants	$206	$211	$206	($5)	27%
Provincial Grants	248	248	248	-	32%
CRD Portion	311	306	321	15	41%
Total	**$765**	**$765**	**$775**	**$10M**	**100%**

Funding from provincial and federal governments totaling $454 million have been received and were used to repay short term construction financing utilized during the project.

Federal grants were received throughout the Project as planned and aided in project cashflow. The amounts received are lower than plan by $5M in relation to the Public Private Partnership (P3) Canada funding agreement. Upon final claim submission, a portion of project costs were deemed ineligible.

Provincial grants were anticipated to be received in two payments with a significant portion retained until substantial completion. The first disbursement of $62M was received on December 11, 2019. In 2020, staff worked with the Province of BC to amend the funding agreement to receive additional funds sooner than initially agreed upon. As a result, an amendment was approved, and the project received $124M on March 30, 2020. This was a year earlier than forecast, resulting in an estimated short-term interest expense savings of $3M dollars. The final $62M of provincial funding was received on October 26, 2021.

The CRD share of $321M has been funded from a variety of sources as planned in the approved project financing strategy. Table 2 below lists total funding by funding source forecast to closeout, and compares the total funding at closeout to original business case (2016) and the financing strategy (2019).

Table 2: Actual Vs. Plan Wastewater Treatment Project Funding – CRD Portion ($ Millions)

Funding Sources	Business Case (2016)	Financing Strategy (2019)	Total (Close Out)	Difference (2019 vs Close)
Requisition	$311	$136	$153	$17
Future Requisition RTF (Present Value)		63	63	-
FCM Loan		20	20	-
FCM Grant		3	3	-
Debt		84	81	(3)
Interest Income			2	2
Total	**$311**	**$306**	**$321**	**$15**

The difference from the 2019 financing strategy is due to the increase in the total Project cost and the shortfall of $5M from federal grants; however, as previously noted, $6.3M remains in the program reserve.

Performance
The financing strategy framework was established for the Project to optimize partner grants and participant funding. This was to be accomplished by minimizing interest expense during construction and to deliver the most cost-effective financing structure.

As a result of timing of early grant payments, early issuances of long-term debt along with active investment and short term debt management, the financing strategy succeeded in optimizing cashflow while also locking in at low interest rates. As a result, the CRD was able to contribute higher cash on hand and interest earned to fund construction. This resulted in less debt required than planned and cash funding available to cover the $10M increase in project budget.

With respect to each of the above, below are the analysis of the performance of the strategy by funding source:

Requisition Capacity
The annual requisition/invoicing amounts were received as expected, as outlined in the original financing strategy, with $155M received over the course of 2013 to 2020. The cumulative transfer to capital was $153M. The method of gradually increasing requisition throughout the course of the Project was successful and resulted in a significant cash contribution to capital and seamless transition into funding of the operating service upon commencement in 2021.

Residuals Treatment Facility – Future Capital Contributions
The RTF cost accounts for approximately $127M of the $775M total project cost. At service commencement, 50% of the $127M RTF cost was paid ($63M), while the remaining 50% ($63M

present value) will be paid over 20 years through requisition. The payment schedule was set by the P3 proponents, through negotiation with the project team. This is in line with the strategy to fund through requisition as opposed to using debt servicing for this component.

FCM loan and grant

Through the Federation of Canadian Municipalities (FCM) Green Municipal Fund (GMF), on June 30, 2021, the CRD entered a $20M loan agreement and received a $3M grant (15% of the loan value) for construction of the first-ever tertiary wastewater treatment plant for Vancouver Island, the final holdback of $0.25M was received March 31, 2022. The grant funding provided with this loan effectively reduced the borrowing costs over the 10-year term to a lower overall effective rate when compared to loans issued at the same time by the Municipal Finance Authority.

Debt

Throughout the Project term, issuances of long-term debt were: $6M in 2013; $15M in 2018; $60M in 2019. The total amount of long-term debt in relation to the project is $81M. The timing of these debt issuances allowed for the CRD to effectively capitalize on low interest rates by locking into long-term debt early, by issuing a large amount of debt—$60M—a lower long-term rate was locked in than if the short-term borrowings had not been paid off until final completion. All debt issued is to be paid as planned by 2032.

Interest

Interest rates generally have significant impacts on financing capital projects. Short-term rates impact the capital project budget via interim financing, while long-term rates impact the operating budget with debt servicing costs and repayment terms. Concurrently, throughout the construction of the Project, the early receipt of funding resulted in interest earnings of $4M, which were used to offset short-term financing costs as they were incurred. As a result of active investment of capital fund balances and early issuances of long-term debt, the capital fund interest earned surplus of approximately $2M, net of short-term interest expense. The surplus interest income offset the funding the shortfall in federal grant revenue.

CONCLUSION

The Capital Regional District is in the closure phase of the Core Area Wastewater Treatment Project. In 2019, a strategy was designed to lower overall costs of financing throughout the Project using a combination of funding, including debt during construction. An evaluation of the financing strategy performance shows the CRD was able to leverage market conditions, mitigate risk of interest rate fluctuation, minimize short-term financing expenses, meet cash flow requirements, and optimize the lowest cost financing structure to its participants. The total forecast cost to final completion is $775 million. Remaining funding will be used to pay out final commitments and transferred to the capital reserve.

RECOMMENDATION

There is no recommendation. This report is for information only.

Submitted by:	Rianna Lachance, BCom, CPA, CA, Senior Manager, Financial Services
Concurrence:	Nelson Chan, MBA, FCPA, FCMA, Chief Financial Officer
Concurrence:	Ted Robbins, B. Sc., C. Tech., General Manager, Integrated Water Services
Concurrence:	Robert Lapham, MCIP, RPP, Chief Administrative Officer

ATTACHMENT(S)

Appendix A: Report to the Capital Regional District Board (Jan 9, 2019) Wastewater Treatment Project (WTP) Financing Strategy
Appendix B: Project Completion Report May 2016 – May 2021

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APPENDIX A

19-016

REPORT TO CAPITAL REGIONAL DISTRICT BOARD
MEETING OF WEDNESDAY, JANUARY 9, 2019

SUBJECT **Wastewater Treatment Project (WTP) Financing Strategy**

ISSUE

The Capital Regional District (CRD) is in the construction phase of the Core Area Wastewater Treatment Project (WTP). The Project has cash flow needs that are being met and managed through a combination of requisition dollars, grant funding, short-term financing and long-term debt. An analysis optimizing risk and financing costs has been completed, including recommended timing of converting of short-term borrowing to long-term debt.

BACKGROUND

On May 25, 2016 the Regional Board of the CRD:

i) Adopted by resolution the Core Area Wastewater Treatment Project Board Terms of Reference (Project Board Terms of Reference) for the purposes of establishing principles governing the Core Area Wastewater Treatment Project (the Wastewater Treatment Project or the WTP);
ii) Established the Core Area Wastewater Treatment Project Board (Project Board) under Bylaw 4109 (the CRD Core Area Wastewater Treatment Board Bylaw No. 1, 2016) for the purposes of administering the Core Area Wastewater Treatment Project; and
iii) Delegated certain of its powers, duties and functions to the Project Board under Bylaw 4110 (the CRD Core Area Wastewater Treatment Project Board Delegation Bylaw No. 1, 2016).

On September 14, 2016 the Regional Board of the CRD:

i) Received the final report of the Project Board with respect to its recommendation for the WTP, dated September 7, 2016 (the Final Report); and
ii) Approved the business case attached as Appendix 1 (the Business Case) to the Final Report.

The Business Case established the WTP control budget (the Control Budget) of $765M.

When completed, the Wastewater Treatment Project will have been funded by a combination of requisition dollars, grant funding and long-term debt.

WTP Project Funding

The 2016 Business Case established a Control Budget of $765M. Both federal and provincial governments are partners in funding the Project. Table 1 summarizes the funding sources and their respective payment terms.

Table 1 – Wastewater Treatment Project Funding Sources

Funding Partner	Payment Terms	Maximum Partner Contribution (in millions)
Building Canada Fund	Released over the course of the Wastewater Treatment Plant (WWTP) construction, upon review and acceptance of progress claims	120
Green Infrastructure Fund	Released over the course of the conveyance construction, upon review and acceptance of progress claims	50
P3 Canada	Released in a single payment upon the Substantial Completion of the Residuals Treatment Facility (RTF)	41
Province of BC	Released in three payments, upon the substantial completion of the WWTP, the RTF, and the Project Commissioning	248
CRD	Contributed over the course of the WTP	306
Total		**$765**

The CRD has discretion over its $306M contribution and its respective financing strategy.

Budget and financing responsibilities

The CRD Core Area Wastewater Treatment Project Board (the Project Board) Bylaw No. 1, 2016 states that the role of the Project Board is to, amongst other things:

- oversee Project scope, schedule and budget as the Project progresses through planning, procurement and implementation phases, with particular attention to risk identification and risk management; and
- work with the Project Director to resolve material issues that may arise over the course of the Project.

The Project Board Terms of Reference require, amongst other things:

- that the Project Board provide the CRD Board with monthly progress reports and a comprehensive quarterly report on the Project.

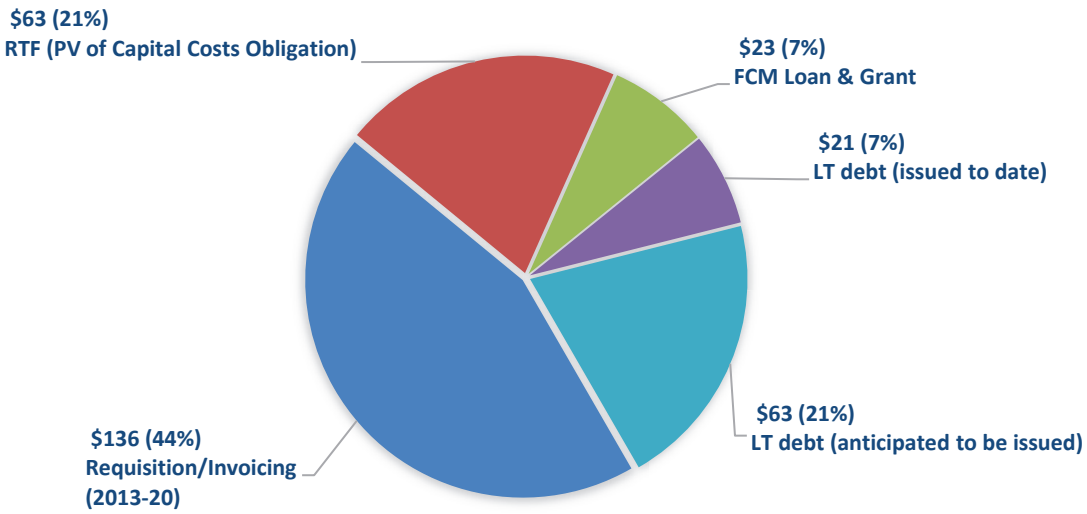
The CRD Board is responsible for the WTP financing strategy and to ensure that funding and cash flow requirements are met.

DISCUSSION

CRD Funding

Figure 1 summarizes the anticipated combination of funding sources for CRD's share of $306M to the WTP.

Figure 1- CRD Funding Sources (in millions)



With respect to each of the contributing funding sources:

Requisition/invoicing (2013-20)

Requisition/invoicing from Core Area Municipalities started in 2013 and increase annually in $5M increments. Through 2018 the District has cumulatively requisitioned $90M from participants and anticipates requisitioning the following annual amounts:

- 2019: $30M
- 2020: $35M
- 2021: $40M and;
- maintaining the requisition level at $40M/year plus annual inflation into future years to fund operating costs, debt serving and, asset replacement / maintenance reserves for the wastewater treatment system.

The annual WTP requisition is reduced by operating expenses incurred in the year, with the net requisition transferred to fund capital costs for the project. Operating expenses include payments on existing debt and WWTP pre-operating costs including; Integrated Water Services (IWS) support services, CRD corporate allocations, chemical and utility costs. The total cumulative WTP requisition for the period of 2013-20 is $155M and the anticipated cumulative transfer to capital is $135.5M or 87%.

RTF Present Value of Capital Cost Obligation

The CRD entered into a Public Private Partnership (P3) agreement in which 50% of the capital costs for the Residual Treatment Facility (RTF) is paid at substantial completion and 50% is paid over the first 20 years of operation. It is projected that the future obligation be paid directly from requisition rather than being debt serviced.

Federation of Canadian Municipalities (FCM) Loan & Grant
An opportunity has been identified with FCM's Green Municipal Fund (GMF), for a $20M loan and $3M grant (15% of the loan value). The CRD performed analysis and determined that the $23M loan and grant yields a better effective interest rate than MFA's present indicative rate. FCM has confirmed that the CRD WTP can bypass the initial-review application process and move directly to the full application stage. CRD intends to submit its application for the loan and grant in early 2019.

Long-term debt - anticipated and issued
To date, the CRD has issued $21M of long-term debt; $6M in 2014 and $15M in 2018. An additional $63M of long-term debt is estimated to be required, to meet CRD's total WTP funding share of $306M. Although the CRD is estimating an additional $63M of long-term debt at the end of the project, this estimate includes assumptions related to project completion and close-out costs. To ensure that the CRD does not overcommit to long-term debt, it is recommended that $60M be included in the 2019 Spring Issue and a final/residual issue be executed at project close-out when the exact value is known.

WTP Financing Strategy Framework
The CRD's Financial Services Department considers all viable options with respect to meeting the Project's cash flow requirements. The base case or standard financing methodology is to use short-term financing to fund project cash flows and convert to long-term debt at project completion. An alternative is to convert a portion of short-term borrowing to long-term debt prior to the end of the construction period.

The primary objectives of the WTP financing strategy are to minimize interest expense during construction and to deliver the most cost effective financing structure, with the lowest overall cost of borrowing to participants.

The financing strategy objectives were balanced with restraints, including but not limited to:
- current and future requisition capacity;
- timing of receipt of grant revenue from Federal and Provincial funding partners;
- timing of receipt of the FCM loan and grant;
- project cash flow needs and the final anticipated long-term debt commitment;
- interest rate trends and overall rate risk.

With respect to each of the above, the CRD has considered the following:

Requisition/invoicing capacity
The annual requisition/invoicing in 2018 is $25M, with incremental increases of $5M/year to a maximum of $40M in 2021 and sustaining into future years. The requisition in 2020 will be funding WWTP operations, RTF operating and capital costs, debt servicing, and asset replacement / maintenance reserves. Debt servicing costs cannot exceed a certain limit to afford appropriate capacity for the other expenses.

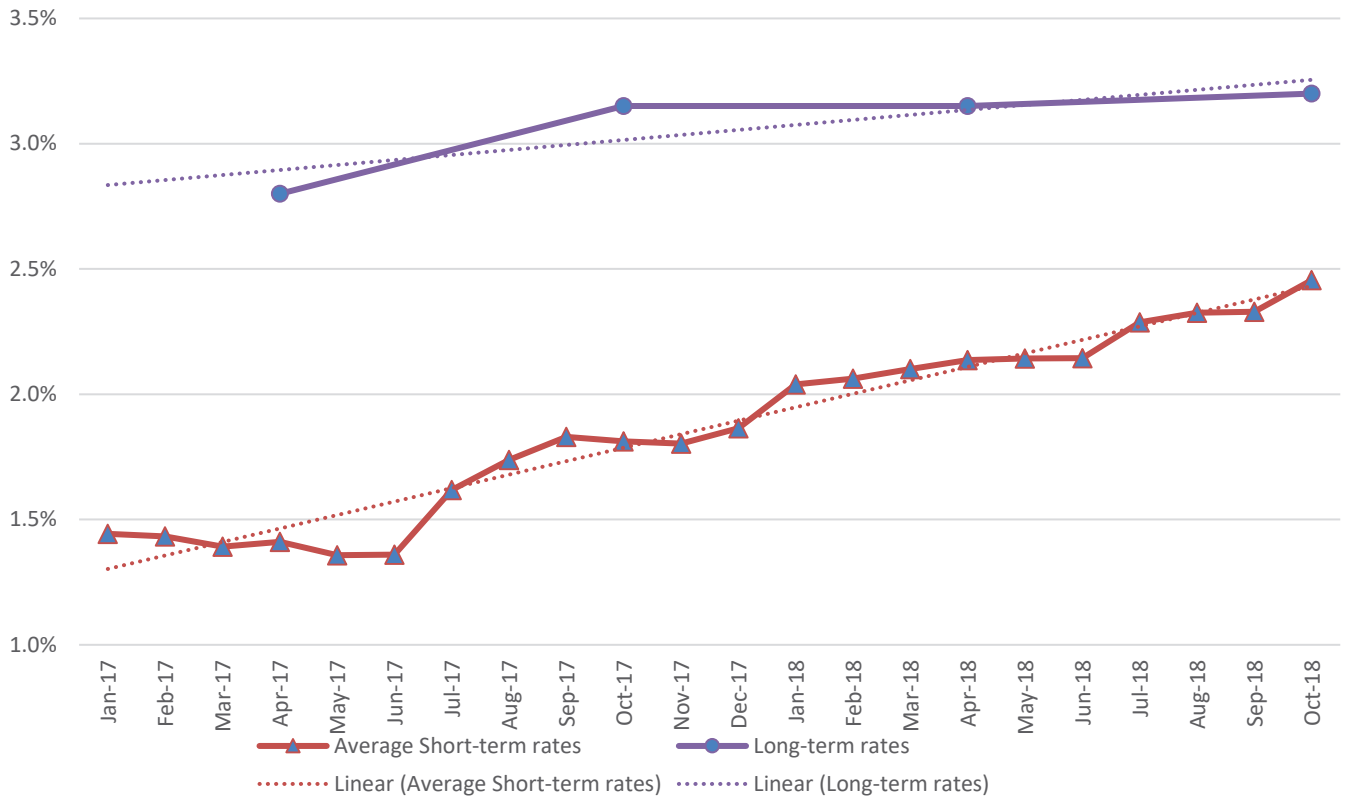
Timing of receipt of grant revenue, FCM loan and grant
The Provincial and P3 Canada contributions (up to $289M) are received at substantial completion, however, the CRD is responsible for the interim financing to meet cash flow requirements. As a result, the CRD will fund the timing difference with short-term financing that will accumulate for the duration of the project. This balance will be repaid upon receipt of grant funding and cannot be converted to long-term debt.

Interest rate trends

Interest rates have significant impact on financing costs. Short-term rates impact the capital project budget via interim financing, while long-term rates impact the operating budget with debt servicing costs and repayment terms. To date, interest rates have shown consistent increases from 2016 onwards.

Figure 2 illustrates interest rate trends since the end of 2016. Specifically, short-term rates with the Municipal Finance Authority (MFA) have increased from 1.34% (Jan 2017) to 2.65% (Dec 2018); long-term (10 year) rates have increased from 2.8% (2017 Spring Issue) to 3.2% (2018 Fall Issue). As of December 4, 2018, the MFA's posted indicative rate for long-term (10 year) borrowing is 3.23%.

Figure 2 – MFA short and long-term interest rates



Debt issuance to date

On March 27, 2013, the CRD Board approved borrowing bylaw No.3887 authorizing the borrowing of $100M for the estimated cost of works related to the WTP. To date $21M of this facility has been used; $6M issued in 2014 and $15M issued in 2018. On April 10, 2013, upon expiry of the quashing period for bylaw No.3887, temporary borrowing Bylaw No. 3888 in the amount of $100M was approved; $66M of this short-term facility has been used to date with the balance anticipated to be used by early 2019.

On September 13, 2017 the CRD Board approved loan authorization Bylaw No. 4204, in the amount of $665M. On July 11, 2018, upon expiry of the quashing period, a temporary borrowing bylaw No.4252 of $300M was approved to fund interim cash flow requirements for the Project. To date, no debt has been applied against this loan authorization.

The total cumulative long-term debt anticipated at the close of the Project is $104M (issued in the amounts of $6M+$15M+$60M+$23M).

2019 Debt Issue
Staff are recommending that $60M for the WTP be included in the security issuing bylaw and approved by the Board for the 2019 Spring Issue. By funding the WTP with long-term debt, risk of interest rate fluctuation can be mitigated and the capital costs of the project will be spread over current and future users.

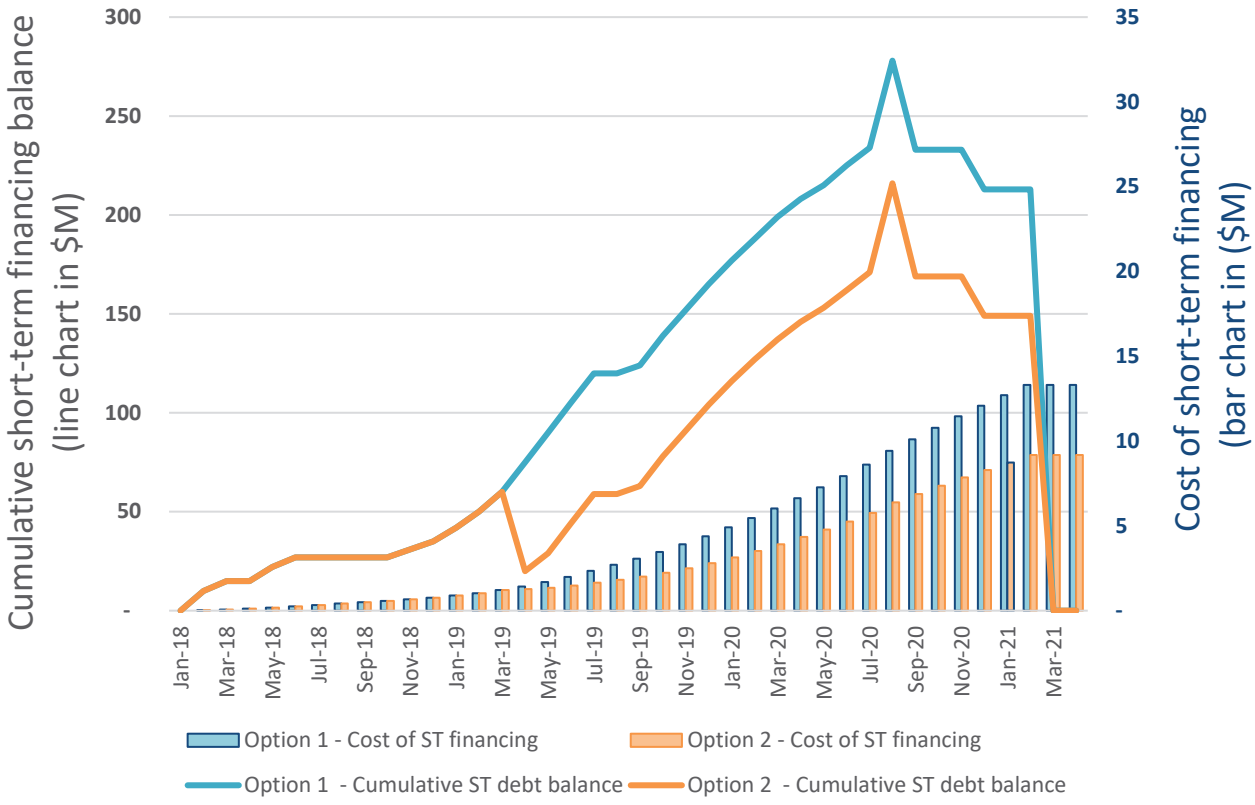
The Municipal Finance Authority's (MFA) Spring Issue is generally funded in April; the anticipated short-term financing balance as at December 21, 2018 is $32M and is estimated to be $50M by April 2019.

When the issue is funded, the long-term debt proceeds will be used to eliminate the short-term financing balance and provide sufficient funds to cash flow the project for approximately one month. Subsequently, the project will rebuild its short-term financing to meet cash flow requirements and provide interim financing for the timing difference in grant funding receipts. The advantage of securing long-term debt and extinguishing the current short-term financing balance is that the CRD will not pay compounding interest charges on the $60M for the duration of the project (estimated to be $3.5M at a short-term financing rate of 3.0%).

Figure 3 illustrates the variance between:
Option 1 - using short-term financing only, for the duration of the project and;
Option 2 – converting $60M of short-term financing into long-term debt and then using short-term financing for the balance of the project.

Depicted below, under Option 1 the cumulative short-term financing balance increases to an estimated $278M at August 2020 and is subsequently repaid upon grant funding receipt and debt issuance; the cumulative cost of interest during construction is estimated to be $13.3M at April 2021. Alternatively, Option 2 reaches a cumulative short-term financing balance of $216M and incurs an estimated $9.2M of interest during construction.

Figure 3 – Short-term financing requirements and cumulative cost of short term financing (in millions).



ALTERNATIVES

Alternative 1
That this report be received for information and that $60M for the Wastewater Treatment Project be included in the security issuing bylaw to be approved by the Board for the 2019 Spring issue.

Alternative 2
That the report be referred back to staff for more information.

FINANCIAL IMPLICATIONS

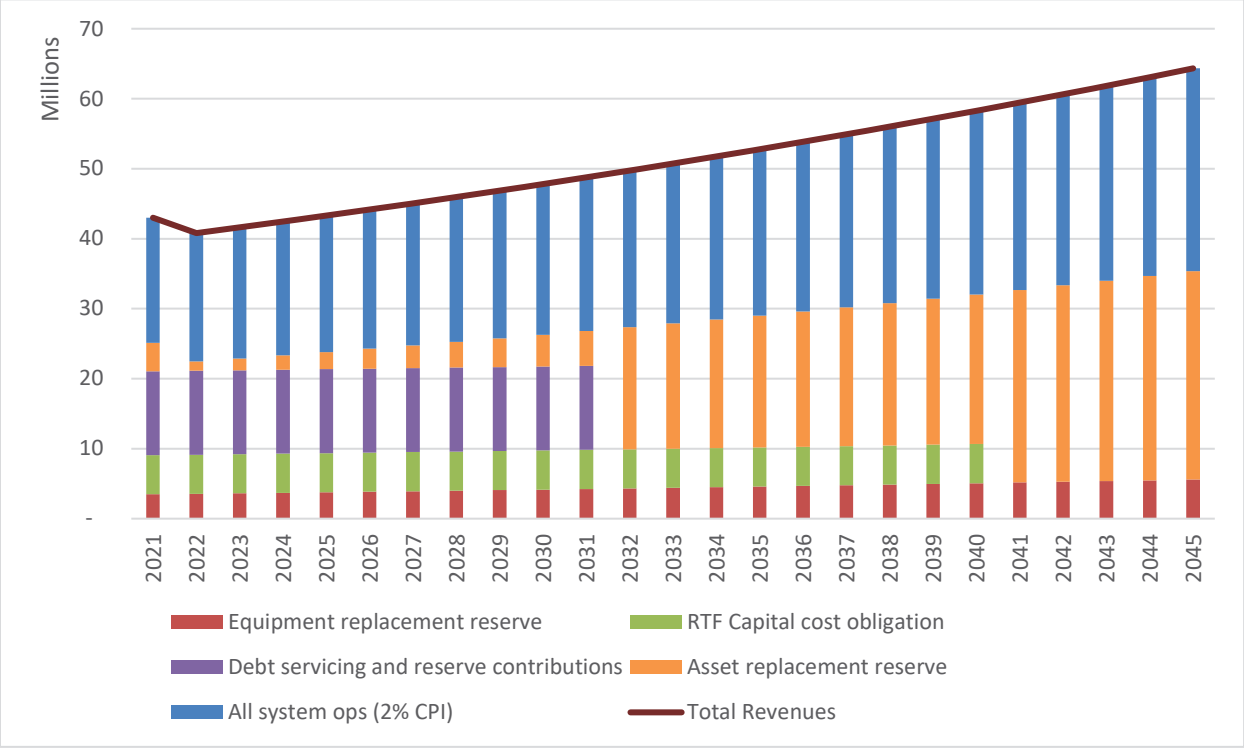
The proposed $60M long-term debt issuance will facilitate financing requirements for the WTP in alignment with the Board approved WTP Control Budget. By securing $60M in long-term debt early, and paying down the cumulative short-term financing balance, the CRD will limit its exposure to interest rate fluctuations, reduce its short-term financing interest expense and can commence principal repayment on debt earlier. Applying $12M of the annual requisition to debt servicing and a debt reserve will make it possible to complete repayment of the $60M long-term debt at its first renewal in 10-years.

Figure 4 illustrates the long-term financial implications of the overall funding strategy. In summary:

- Requisition levels are maintained at $40M with annual inflation

- Debt of $60M is issued in the 2019 Spring Issue (forecasted interest rate of 4%)
- Annual contribution to debt serving and debt reserve is $12M, enabling the repayment of the long-term debt at its 10 year renewal
- FCM loan is fixed for a 20 year term
- A final long-term borrowing is completed for residual expenditures at project close out (estimated at $3M)
- Asset replacement reserve contributions commence in 2021 and accumulate (estimated reserve balance at 2045 is $352M)

Figure 4 – Long-term view of ongoing requisition/invoicing



After the 2019 Spring Issuance, the WTP will access short-term financing to finance the timing differences in funding and cover project costs as approved in the Control Budget; providing access to low cost funding and the flexibility to borrow and repay in short notice. Short-term financing, unlike long-term debt can be repaid at any time without notice or penalty and are flexible to the construction schedule and to the receipt of grant funding from federal and provincial governments. The short-term financing will allow the CRD to continue to manage financing costs, mitigate timing differences in expenditures and grant receipts and access funds as needed, with long-term debt secured/converted at an optimal period.

CONCLUSION

Approval of the $60M long-term debt issuance is recommended to ensure that the CRD is able to leverage current market conditions, mitigate risk of interest rate fluctuation, minimize short-term financing expense, continue to meet cash flow requirements and optimize on the lowest cost financing structure to its participants.

RECOMMENDATION(S)

That this report be received for information and that $60M for the Wastewater Treatment Project be included in the security issuing bylaw to be approved by the Board for the 2019 Spring issue.

Submitted by:	Agnes Piotrowski, CPA, CA, Manager, Finance, Major Projects
Concurrence:	Nelson Chan, MBA, CPA, CMA, Chief Financial Officer
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AP: nm

CRD Wastewater Treatment Project

Project Completion Report

Reporting Period: May 2016 to May 2021

TABLE OF CONTENTS

1 Executive Summary

1.1 Wastewater Treatment Project

The Wastewater Treatment Project (the Project) provides tertiary treatment of wastewater from the core area municipalities of Victoria, Esquimalt, Saanich, Oak Bay, View Royal, Langford and Colwood, and the Esquimalt and Songhees Nations.

The Wastewater Treatment Project was built to meet the provincial and federal regulations for treatment by December 31, 2020. The Project consists of three main components:

- McLoughlin Point Wastewater Treatment Plant: located at McLoughlin Point in Esquimalt, the treatment plant provides tertiary treatment to the core area's wastewater.
- Residuals Treatment Facility: residual solids from the wastewater treatment plant are piped to a Residuals Treatment Facility at Hartland Landfill, where they are turned into what are known as Class A biosolids. These biosolids are a high-quality byproduct treated such that it is safe for further use.
- Conveyance System: the conveyance system refers to the 'pumps and pipes' of the Wastewater Treatment Project. This system carries wastewater from across the core area to the treatment plant, and residual solids to the Residuals Treatment Facility at Hartland Landfill, and also includes an attenuation tank that temporarily stores wastewater flows during high volume storm events to reduce the number of sewer overflows.

The Capital Regional District (the CRD) planned, procured and constructed the Wastewater Treatment Project over the period from May 2016 to May 2021, with some obligations remaining to be fulfilled beyond that date, as summarised in Section 7 of this report. The federal and provincial governments assisted the Capital Regional District in funding the project.

1.2 Project Performance

1.2.1 Achievement of Project Goals

The CRD Board established the following four goals for the Wastewater Treatment Project:

- Meet or exceed federal regulations for secondary treatment by December 31, 2020.
- Minimize costs to residents and businesses (lifecycle costs) and provide value for money.
- Optimize opportunities for resource recovery and greenhouse gas reduction.
- Deliver a solution that adds value to the surrounding community and enhances the liveability of neighbourhoods.

The Wastewater Treatment Project met all four of these goals.

The McLoughlin Point Wastewater Treatment Plant met and exceeded federal regulations when it commenced treating the Core Area’s wastewater to a tertiary level before December 31, 2020. Lifecycle costs were considered at every stage of Project planning and delivery in order to minimize the costs to residents and businesses, and provide value for money. By way of example:

- Starting at the planning stage, a cost effective Project scope and configuration were selected and funding agreements were executed with senior levels of government for a significant portion (60%) of the Project's total cost;
- During the procurement stage competitive selection processes were used to ensure competitive pricing was received for the construction of the Project, and the lifecycle costs of the Project's facilities were evaluated as part of those procurements;
- Lifecycle costs were also considered during design development; and
- Proactive risk management was undertaken at every stage of Project delivery.

Environmental considerations were part of every major decision for the Project, with the result that:

- residual solids produced by the McLoughlin Point Wastewater Treatment Plant are processed into Class A biosolids at the Residuals Treatment Facility: this is the highest quality product allowing for the broadest range of beneficial uses; and
- the design of each of the new major Project facilities (being the McLoughlin Point Wastewater Treatment Plant, the Residuals Treatment Facility and the Macaulay and Craigflower Pump Stations) incorporated Leadership in Energy and Environmental Design (LEED) principles.

To enhance the livability of neighbourhoods, the Wastewater Treatment Project worked with the surrounding communities to identify amenities and/or infrastructure improvements that were either funded by the Project, or funded and delivered by the Project. In addition and in order to minimize the impact of the Project on host communities, all Project components include advanced odour treatment such that there will be no discernible odour by residents.

Section 5.1 of this report provides more detail regarding how each of the Project's goals were achieved.

1.2.2 Key Performance Indicators at Project Completion

The realization of the Project's vision and goals was monitored against the key performance indicators approved by the Project Board. The Project Director reported performance against these key performance indicators to the Project Board on a monthly basis, and their status at Project Completion has been assessed to be as shown in Table 1.

Safety was the Project's top priority: safety of the public, construction workers and CRD staff, including those responsible for delivery of the Project and for its ongoing operation and maintenance. As of May 2021, the vast majority of construction has been completed (the Arbutus Attenuation Tank and Clover Point Pump Station are the only Project sites with some minor construction activities remaining) with zero fatalities and a safety-first culture maintained within the CRD and all Project Contractors.

Schedule was a critical Project driver, specifically the need to meet or exceed federal regulations for secondary treatment by December 31, 2020. As already noted, the McLoughlin Point Wastewater Treatment Plant met and exceeded federal regulations when it commenced treating the Core Area's wastewater to a tertiary level before December 31, 2020, and, through the addition of the Project components to the core area wastewater system, the system can be operated in compliance with provincial and federal wastewater regulations.

Cost was an important consideration throughout Project planning and delivery. While the total Project cost will not be known until total completion of all contracts, which is anticipated to occur

in the last quarter of 2021, it is forecast that the total Project cost will be approximately $766.7M, which is within the approved budget of $775M. The total Project cost is therefore forecast to exceed the Project's Control Budget (of $765M) by 0.2%, but be well within the budget subsequently-approved by the CRD Board (of $775M).

Over the period of Project delivery, budget pressures included inflation in the cost of labour and materials and design changes from stakeholder input. Considering the constraints of the Project's schedule (which necessarily required an ambitious schedule in order to meet the federal regulations for treatment of wastewater by December 31, 2020) and the onset and continuation of a global health pandemic over the final year of the Project's construction schedule, delivering the Project within 0.2% of the Project's original budget is a significant achievement.

Table 1 – Status of Key Performance Indicators at Project Completion

Key Performance Indicator			Comments
Safety	Deliver the Project safely with zero fatalities and a total recordable incident frequency (TRIF) of no more than 1*.		As of May 2021, the vast majority of construction has been completed (the Arbutus Attenuation Tank and Clover Point Pump Station are the only Project sites with some minor construction activities remaining), there have been zero fatalities and the TRIF was 1.5. While this exceeds the Project's ambitious target of no more than 1, it was less than half the industry average: WorkSafe BC records the TRIF for various industries, and for 2018 (the most recent year for which information has been published) the TRIF for heavy construction was 3.2.
Environment	Protect the environment by meeting all legislated environmental requirements and optimizing opportunities for resource recovery and greenhouse gas reduction.		The Project met all legislated environmental requirements and, through the design of the various components optimized opportunities for resource recovery and greenhouse gas reduction. Over the course of construction there were a relatively small number of environmental incidents: they were all diligently-managed, appropriately-reported and mitigated as required, with the result that there weren't any long-term impacts. An unexpectedly-significant environmental benefit of the Project included the remediation of McLoughlin Point.
Regulatory Requirements	Deliver the Project such that the Core Area complies with provincial and federal wastewater regulations.		Through the addition of the Project components to the core area wastewater system, the system can be operated in compliance with provincial and federal wastewater regulations.
Stakeholders	Continue to build and maintain positive relationships with First Nations, local governments, communities, and other stakeholders.		Significant efforts were made to engage with and provide accurate and timely information to stakeholders throughout the delivery of the Project. Through these efforts and the achievement of the Project's goals, positive relationships were built and maintained with First Nations, local governments, communities, and other stakeholders.
Schedule	Deliver the Project by December 31, 2020.		The Project completed the majority of construction by December 31, 2020, and achieved its schedule-related goal, which was to meet or exceed federal regulations for secondary treatment of wastewater by December 31, 2020. All aspects of the Project that were required to meet the regulatory requirements were delivered by December 31, 2020. As of May 2021, commissioning of the Residuals Treatment Facility is ongoing and is anticipated to be complete in June 2021, and the Arbutus Attenuation Tank and Clover Point Pump Station are the only Project sites with some minor construction activities remaining.
Cost	Deliver the Project within the Control Budget ($765 million).		While the total Project cost will not be known until total completion of all contracts, which is anticipated to occur in the last quarter of 2021, it is forecast that the total Project cost will be approximately $766.7M, which is within the approved budget of $775M. The total Project cost is therefore forecast to exceed the Project's Control Budget (of $765M) by 0.2%, but be well within the budget subsequently-approved by the CRD Board (of $775M).

* A TRIF of no more than 1 means that there is 1 or fewer recordable incidents (being a work-related injury or illness that requires medical treatment beyond first aid or causes death, days away from work, restricted work or transfer to another job, or loss of consciousness) for every 200,000 person-hours of work

Status	Description
	Significant adverse effect of KPI not being met
	KPI not met but outcome managed
	KPI achieved

Section 5.2 of this report provides more detail regarding Project delivery with respect to the Project's key performance indicators.

1.3 Purpose of this Project Completion Report

The purpose of this Project Completion Report is to mark the completion of the Wastewater Treatment Project by:

- assessing the Project's performance against the goals established by the CRD Board (see section 5.1) and the key performance indicators approved by the Project Board (see section 5.2);
- identifying variances from the baseline plans prepared by the Project Board and/or Project Team, in terms of the Project's scope (see section 4), schedule (see section 5.2.5) and cost (see section 5.2.6);
- identifying Project successes and challenges (see section 6); and
- outlining the Project-related commitments and activities that extend beyond May 2021 (see section 7).

Note that another document (the Governance Transition Report) provides more details regarding the project closure activities that have been completed to-date, and the Project-related commitments that extend beyond May 2021.

2 Project Context

2.1 Project Need

The Capital Regional District (CRD) was incorporated in 1966 to provide regional decision-making on issues that transcend municipal boundaries and to enable effective service delivery to residents regionally, sub-regionally and locally. Today, the CRD is the regional government for 13 municipalities and three electoral areas on southern Vancouver Island and the Gulf Islands, serving more than 425,000 people.

The Core Area of the CRD includes seven municipalities and two First Nations within the CRD with a total land area of approximately 215 km^2. The Core Area communities are the Cities of Victoria, Langford, and Colwood, the Districts of Oak Bay and Saanich, the Township of Esquimalt, the Town of View Royal, and the Songhees and Esquimalt Nations. One of the services that the CRD provides for the Core Area is the regional sewage system, which serves a population of approximately 320,000 (as estimated in 2019) in the Core Area.

Until 2020, all wastewater from the Core Area was conveyed to preliminary treatment facilities at Clover Point in Victoria and Macaulay Point in Esquimalt, where it was screened prior to marine discharge. Preliminary treatment was provided by 6 mm fine screening to remove rocks and solids, plastic, and floatable materials. The removed materials were trucked to, and disposed of, at the Hartland Landfill. No other treatment occurred prior to the wastewater being discharged into the marine environment from one of two outfalls, located at Clover Point and Macaulay Point. The CRD was the last major coastal community in North America discharging untreated sewage into the marine environment.

Provincial Municipal Wastewater Regulations (“MWR”) under the Environmental Management Act came into effect in 2012 to, “protect public health and the environment”. The Municipal Wastewater Regulations prescribes the minimum standards of municipal wastewater quality for marine water, fresh water, or ground discharge.

Federal Wastewater System Effluent Regulations (“WSER”) under the Fisheries Act also prescribe effluent quality performance standards. WSER's objective is to decrease the level of deleterious and harmful substances discharged through wastewater effluent. Facilities discharging effluent quality not equivalent to or better than the secondary treatment performance standards are required to be upgraded. Facilities considered high risk, such as those at Macaulay Point and Clover Point were required to be upgraded by December 31, 2020, in accordance with the deadline set out in the transitional authorizations for those facilities.

Failure to comply with the WSER and the MWR could have resulted in regulatory enforcement action in the form of prosecution, fines, imprisonment, and other remedial penalties.

2.2 First Nations

The Core Area, and therefore the Project components, lie within or near the traditional territories of 16 First Nations.

The First Nations most closely associated with the Wastewater Treatment Project are the Esquimalt and Songhees. Their communities are located in the Core Area within close proximity to the McLoughlin Point Wastewater Treatment Plant and other Project components. The

Esquimalt and Songhees First Nations are participants in the Core Area Liquid Wastewater Service and the CRD is currently establishing updated service agreements with the Nations.

There are four First Nations with communities near the Core Area, but outside the Core Area wastewater system. They are the Tsawout, Tseycum, Tsartlip, and Pauquachin (the W̱SÁNEĆ Nations). The Residuals Treatment Facility and parts of the Conveyance System are located within their traditional territories.

Additionally, there are ten other First Nations with Treaty rights in the general vicinity of the Core Area, which are primarily fishing rights in the Strait of Juan de Fuca. These Nations are the Scia'new (Beecher Bay), Stz'uminus, Halalt, Penelakut Tribe, T'Sou-ke, Lyackson, MÁLEXEŁ (Malahat), Lake Cowichan, Cowichan Tribes, and Nanoose First Nation (which is included because it is represented by a tribal association, the Te'mexw Treaty Association, which was formed by some of these Nations).

3 Project Delivery

3.1 Governance

3.1.1 CRD Board

The CRD is governed by a 24-member Board of Directors, composed of one or more elected official from each of the local governments within the CRD's boundaries.

In order to meet federal and provincial wastewater regulations, on May 25, 2016 the Regional Board of the CRD (the “CRD Board”) established the Wastewater Treatment Project Board (the “Project Board”) under Bylaw 4109 (the “CRD Core Area Wastewater Treatment Board Bylaw No. 1, 2016”) for the purposes of administering the Project. The CRD Board adopted by resolution terms of reference (“Terms of Reference”) for the Project Board for the purposes of establishing principles governing the Project. The Terms of Reference are attached as Schedule “A” to the CRD Core Area Wastewater Treatment Board Bylaw No. 1, 2016. The CRD Board asked the Project Board to review the wastewater treatment issues and, by September 2016, recommend to the CRD and senior levels of government a plan to comply with the law and to preserve senior government funding.

On May 25, 2016 the CRD Board also delegated certain of its powers, duties and functions to the Project Board under Bylaw 4110 (the “CRD Core Area Wastewater Treatment Project Board Delegation Bylaw No. 1, 2016”). Notwithstanding the delegation of authority from the CRD Board to the Project Board, the delegation bylaw included the requirement that approval from the CRD Board would be required for any alteration to the scope, schedule or budget of the Project that would result in the Project not meeting provincial and federal regulations governing the Project, exceeding approved funding for the Project, or increasing costs to taxpayers from those stated in the Business Case.

The CRD Board had previously established the CRD Core Area Liquid Waste Management Committee (“CALWMC”) to oversee and make recommendations to the CRD Board regarding the Core Area Liquid Waste Management Plan, and progress on the Project was reported to the CRD Board through the CALWMC.

3.1.1.1 Project Vision and Goals

The Project Board’s Terms of Reference (as established by the CRD Board) included the following vision for the Project:

- Deliver a sewage treatment and resource recovery system that is innovative, achievable and optimizes benefits - economic, social and environmental (including climate change mitigation) - for the long term.
- Approach the Project from the perspective that waste materials should be treated as resources and managed as such, with a long term objective to create a system that supports the principles of Integrated Resource Management (“IRM”).
- Give consideration to, and reflect, public input received with an objective of being responsive to community values and concerns.

The Terms of Reference included the following goals to support achieving the vision:

- Meet or exceed federal regulations for secondary treatment by December 31, 2020.

- Minimize costs to residents and businesses (lifecycle costs) and provide value for money.
- Optimize opportunities for resource recovery and greenhouse gas reduction.
- Deliver a solution that adds value to the surrounding community and enhances the liveability of neighbourhoods.

3.1.2 Project Board

In accordance with the bylaw that established it (the "CRD Core Area Wastewater Treatment Board Bylaw No. 1, 2016"), the Project Board consisted of seven members appointed by the CRD Board, one of whom was the Chief Administrative Officer of the CRD.

The Project Board's role and function as defined in the Terms of Reference was as follows:

- Be responsible for overall planning, Project management, site acquisition, expenditures, and liquid waste management planning for the purposes of the Project.
- Select a Project Director to oversee all aspects of the Project.
- Provide direction and guidance to the Project Director on Project matters, including the development of a decision making framework, business priorities, strategies and resource approval, and appropriate Project controls and reporting procedures.
- Manage the development of a comprehensive Business Case for submission to the federal and provincial governments to confirm funding to proceed to Project implementation.
- Appoint or confirm advisors including fairness advisor and conflict of interest adjudicator.
- Oversee Project scope, schedule and budget as the Project progresses through planning, procurement and implementation phases, with particular attention to risk identification and risk management.
- Work with the Project Director to resolve material issues that may arise over the course of the Project.
- Oversee Project communications, information and consultation activities.

3.1.2.1 Final Report and Business Case

Upon establishment, the Project Board heard delegations and presentations from the public, industry professionals, and a CRD Director. The Project Board Chair and Vice Chair also met with staff from the CRD and all of the Core Area municipalities, and with Esquimalt and Songhees Nations representatives.

The Project Board reviewed the previous technical work and extensive public commentary and developed a methodology to review and evaluate all options. This methodology included evaluation of a large number of options to identify a short list that best addressed the Project goals.

The Project Board developed detailed cost estimates for the short-listed options, ranked the short list using triple bottom line (economic, social and environmental) criteria, and identified the best option. This option was the basis of the final report of the Project Board with respect to its recommendation for the Project, dated September 7, 2016 (the "Final Report").

On September 14, 2016 the CRD Board received the Final Report and approved the business case attached as Appendix 1 (the "Business Case") to the Final Report. The Business Case defined the scope of the Project and established the control budget of $765 million (the "Control Budget").

Following the CRD Board's approval of the Business Case, the CRD submitted amendment number 11 ("Amendment 11") to the Core Area Liquid Waste Management Plan ("CALWMP") to the British Columbia Ministry of Environment. The CALWMP is a 25-year plan under the Environmental Management Act which outlines the CRD's wastewater management strategies, including wastewater treatment.

On September 30, 2016, the British Columbia Ministry of Environment provided conditional approval of Amendment 11 to the CALWMP, and on November 18, 2016 provided a revised conditional approval that superseded the September 30, 2016 approval. The November 18, 2016 conditional approval clarified: that primary treatment is to be guaranteed for Clover Point catchment flows of up to three times average dry weather flows[1]; and that a definitive plan providing a solution for the beneficial use of biosolids that does not incorporate multi-year storage of biosolids within a biocell was to be submitted to the British Columbia Ministry of Environment by June 30, 2019. The November 18, 2016 conditional approval further mandated that the CRD's solution for the beneficial use of biosolids meet the requirements for beneficial use specified in the Canadian Council of Ministers of the Environment 'Canada-Wide Approach for the Management of Wastewater Biosolids' (October 11, 2012).

The CRD therefore needed to develop a definitive plan for the beneficial use of the biosolids to be produced at the Residuals Treatment Facility, that met the requirements of the British Columbia Ministry of Environment's conditional approval.

Once the Project had concluded the procurement for the Residuals Treatment Facility, the nature of the biosolids to be beneficially-used was known. At that point the CRD undertook a process (separate to the Project and based on the nature of the biosolids to be produced by the Residuals Treatment Facility) with the participation of municipalities and First Nations, to review its regional waste management policy and develop a definitive plan for the beneficial use of biosolids and integrated resource management.

3.1.3 Project Director

In accordance with the CRD Core Area Wastewater Treatment Project Board Delegation Bylaw No. 1, 2016, in December 2016 the Project Board appointed a Project Director to oversee all aspects of the Project. In accordance with the Terms of Reference, the Project Director was responsible for leading a Project team to plan, procure, and implement the Project.

The Project Board also appointed a Deputy Project Director. The Project Director and Deputy Project Director were delegated authority in accordance with Bylaw 4186 (the "CRD Delegation Bylaw No. 1, 2017"), which delegates to the CRD's officers and employees the authority to acquire and purchase goods and services on behalf of the CRD, subject to the CRD's purchasing policies and procedures, and signing authority limitations.

[1] The average dry weather flow (ADWF) is the average daily flow during the dry weather season: the average dry weather season for the core area is from June 1 to August 31.

3.2 Project Delivery Strategy

3.2.1 Project Team

In accordance with the Terms of Reference, the Project Director assembled a Project team:

- to carry out the work of the Project on behalf of the Project Board; and
- that included the relevant expertise required for the Project, including financial, technical, estimating, communication and consultation, procurement and legal expertise.

The Terms of Reference noted that membership of the team was to reflect the requirements of the work at a particular time and may change over time. The Project Director established the Project Team based on the contracting strategies outlined in Table 2 (in the following sub-section). The composition of the Project Team is outlined in the Project Management Plan, and was supported by consultants as required to provide specialist expertise and balance the changing resource needs over the course of Project delivery.

The Project Team reported directly to the Project Director and Deputy Project Director and as part of their overall Project execution and delivery responsibilities had the following duties:

- Project execution and delivery;
- Stakeholder relations, communication management and reporting;
- Project controls, including document control, cost control, schedule, risk management and reporting;
- Financial management, primarily through integration with CRD's Finance Department, including for: cash flow management, payment processing, and financial controls;
- Managing scope and monitoring engineering and construction activities;
- Overseeing the Project contractors' safety, environmental and quality performance; and
- Integrating with CRD departments throughout the delivery of the Project.

The Project Director determined that it would be useful for the Project Team to refer to guidance documents as they delivered the Project, and to this end the following documents were prepared by the Project Team and approved by the Project Board:

- Project Charter: the Project Charter included the Project's goals (as defined by the CRD Board), and established the parameters and mandate for the Project Team to execute and deliver the Wastewater Treatment Project, including key performance indicators against which delivery of the Project could be assessed. The Project Charter was first approved by the Project Board on April 4, 2017, and was subsequently updated twice to account for progress made on delivering the Project, with each update approved by the Project Board (on April 27, 2018 and September 30, 2019).

- Project Management Plan: the Project Management Plan specified the project management objectives and approaches intended to be used to achieve the key performance indicators (as established in the Project Charter); and stated the key organizational roles and responsibilities anticipated to be required to provide effective management, administration and control of the Project. The Project Management Plan was approved by the Project Board on September 26, 2018.

- Risk Management Plan: the Project's Risk Management Plan included the risk management process, roles and responsibilities, management escalation hierarchy and requirements for risk meetings and reporting cycles, in order to direct and empower the Project Team to: develop and maintain a 'risk aware' culture; provide a comprehensive risk identification and control process; and to proactively forecast and report on risks. The Project's Risk Management Plan was approved by the Project Board on March 29, 2018.
- Communications and Engagement Plan: the Project's Communications and Engagement Plan defined the Project's communications and engagement goals, described the communications and engagement activities and described the roles and responsibilities of the Project's Communications and Engagement Team, which included CRD staff, consultants and representatives from the contractors for each component of the Project. The Project's Communications and Engagement Plan was first approved by the Project Board on April 4, 2017, and was subsequently updated twice to account for progress made on delivering the Project, with each update approved by the Project Board (on July 26, 2018 and July 25, 2019).

3.2.2 Prime Contractors

Given the risk profile, overall scale and diverse scope, the Project Board determined that the Project would be delivered through a number of contracts with a variety of contracting strategies, and in the Business Case outlined the rationale for: the McLoughlin Point Wastewater Treatment Plant to be delivered through a design-build-finance contract; the Residuals Treatment Facility to be delivered through a design-build-finance-operate-maintain contract; the Macaulay and Clover Point Pump Stations to be delivered through design-build contracts, and the remainder of the conveyance system to be delivered through design-bid-build contracts. The Project Team determined the packaging for the conveyance system, with consideration of: market capacity; the design, construction and commissioning schedule for each aspect of the conveyance system; and the interfaces between each Project component. The selected contracting and packaging strategy is outlined in Table 2.

The Project Team ran competitive selection processes to select a construction contractor for each Project component. The procurements were open for any interested party to participate in, were advertised on BC Bid (a website that allows public sector organizations to advertise opportunities for contracts for a wide range of goods and services), and followed CRD's purchasing policy as applicable to the procurement. The construction contractors selected through these processes are summarised in Table 2.

In order to manage scope and interface risks the Project Team used a single owner's engineer to develop the indicative design for all critical Project components with significant interfaces. The indicative design formed the basis for defining the key interfaces between Project components. Stantec were retained as the owner's engineer for the overall Project, as they had been engaged by the CRD during an earlier stage of Project development. In addition and as shown in Table 2, the Project Team retained a design consultant for each Project component delivered through a design-bid-build contract.

Table 2 – Contracting Strategy, Design Consultant and Construction Contractor

Project Component	Contract	Contracting Strategy	Design Consultant	Construction Contractor
McLoughlin Point Wastewater Treatment Plant	McLoughlin Point Wastewater Treatment Plant	Design-build-finance	Harbour Resource Partners (Graham Infrastructure and AECOM Canada)	
Residuals Treatment Facility	Residuals Treatment Facility	Design-build-finance-operate-maintain	Hartland Resource Management Group (Synagro Capital, Maple Reinders PPP Ltd., Bird Construction Inc.)	
Conveyance System	Clover Point Pump Station	Design-build	Kenaidan Contracting Ltd.	
	Clover Forcemain	Design-bid-build	Kerr Wood Leidal	Windley Contracting Ltd.
	Macaulay Point Pump Station & Forcemain	Design-build	Kenaidan Contracting Ltd.	
	Craigflower Pump Station[2]	Design-bid-build	Associated Engineering	Jacob Bros Construction
	Residual Solids Conveyance Line	Design-bid-build	Parsons	Don Mann Excavating Ltd.
	Residual Solids Pump Stations	Design-bid-build	Parsons	Knappett Projects Inc.
	Arbutus Attenuation Tank	Design-bid-build	Kerr Wood Leidal	NAC Constructors Ltd.
	Trent Forcemain	Design-bid-build	Stantec	Jacob Bros Construction

3.2.3 CRD Integration and Support

CRD integration and support was critical to the successful delivery of the Project. The Project Board and Project Team completed the tasks delegated to them with:

- ongoing co-ordination between the Project Team and the two CRD departments that have responsibilities for commissioned Project components, being:
  - the CRD's Integrated Water Services department, who are responsible for the operation and maintenance of all Project components (upon commissioning) other than the Residuals Treatment Facility; and
  - the CRD's Parks and Environmental Services department, who are responsible for: the CRD's Core Area Liquid Waste Management Plan; the environmental monitoring and regulatory compliance reporting for the core area wastewater system; and the administration of the Residuals Treatment Facility contract post May 2021; and

[2] The Craigflower Pump Station was delivered by the CRD between 2013 and 2015, before the Project Board were established.

- the support of many CRD departments, including Corporate Communications, First Nations Relations, Human Resources, Legislative and Corporate Services, and Finance and Technology.

The CRD integration and support occurred through various avenues, including the following:

- The Chief Administrative Officer's appointment as a member of the Project Board;
- Monthly executive leadership meetings attended by the Project Director, Deputy Project Director and the CRD's Chief Administrative Officer, Chief Financial Officer, and General Managers of Parks and Environmental Services and Integrated Water Services;
- Monthly project coordination meetings attended by Project Team members and members of relevant CRD departments, including Integrated Water Services, Parks and Environmental Services, First Nations Relations, and Properties;
- The participation in design review and hazard and operability workshops of members of the Integrated Water Services and Parks and Environmental Services departments;
- The review of contract submittals (e.g. operating plans) by members of the Integrated Water Services and Parks and Environmental Services departments; and
- Interaction between designated CRD and Project Team personnel responsible for ensuring integration on specific subjects, as outlined in Appendix 3 of the Project Management Plan.

Particular support and integration was provided by the following CRD individuals and departments:

- The CRD's Chief Financial Officer - both directly and through finance staff seconded to the Project Team and through information technology support - was responsible for:
    - ensuring compliance with local government financial reporting requirements;
    - coordinating with the Project Team's Finance Manager to efficiently structure Project cash flows and financing;
    - seeking the CRD Board's approval for the means by which the Project's cash flow and financing needs were met;
    - shaping the overall financing strategy of the Project; and
    - providing information technology support to the Project.
- The CRD's Senior Manager, Human Resources and Corporate Safety was responsible for all aspects of human resources, labour relations, organizational development, and occupational health and safety leadership, direction and support for the CRD. Specific to the Project:
    - all matters regarding employment were overseen by the CRD's Human Resources and Corporate Safety division, under the direction of the CRD's Senior Manager, Human Resources and Corporate Safety and the authority of the CRD's Chief Administrative Officer; and
    - the CRD's Manager, Corporate Occupational Health & Safety was responsible for supporting the Project Team's Safety Manager in the performance of their responsibilities by periodically reviewing the status of the Project's safety activities and initiatives.
- The CRD's Senior Manager, Corporate Communications was point of contact for media, responsible for coordinating with the Project Team to manage media inquiries

related to the Project. This included local, regional, provincial, national, and at times international, media.

- The Manager of CRD's First Nations Relations was responsible for:
  - the ongoing maintenance of CRD's government-to-government relationships with First Nations; and
  - coordinating with the Project Team on Project-related First Nations engagement.
- The CRD's Corporate Services Department:
  - provided professional advice and expertise related to legislative services, information services, risk and insurance management, real estate services; and
  - was responsible for administration of the Freedom of Information and Protection of Privacy Act;
- Representatives from CRD's Integrated Water Services department were engaged in the review of design and construction submittals and provided input regarding CRD standards and operations and maintenance considerations. Specific responsibilities included participating in design review and hazard and operability workshops, and reviewing and providing comments on relevant contract submittals (e.g. design reports, drawings and operating plans).
- Representatives from CRD's Parks and Environmental Services department were engaged in the:
  - review of applications for permits and authorizations that extend beyond the Project delivery period, including the registration of the McLoughlin Point Wastewater Treatment Plant under the Municipal Wastewater Regulations; and
  - review of specific design and construction submittals for the Residuals Treatment Facility. Specific responsibilities included: participating in design review workshops, and reviewing and providing comments on contract submittals (e.g. design reports, drawings, operating plans), with a focus on the interfaces between the operations of the Hartland Landfill and the Residuals Treatment Facility.

Each service that the CRD provides has its own budget and must be accounted for and reported on separately: the CRD Financial Plan consists of more than 200 individual service budgets, which fund delivery of regional, sub-regional and local services. In accordance with this, the Project's budget included annual payments to the CRD departments that supported the Project Board and Project Team.

3.2.4 Project Reporting

The reporting requirements for the Project were defined with consideration of the Project Board Terms of Reference, the approved senior government funding agreements and the financial and accounting reporting cycle of the CRD. The Project Board's Terms of Reference required the Project Board to provide the CRD Board with monthly progress reports and a comprehensive quarterly report on the Project.

Throughout the delivery of the Project, the Project Team prepared comprehensive monthly and quarterly reports which described the status of the Project, and specifically addressed the progress with respect to scope, budget, commitments, project expenditures, schedule and risk status. The reports included a dashboard and executive summary which highlighted material

changes in any of these areas, and summarised progress on the delivery of each Project component. These reports were presented to the Project Board in open reports, and subsequently to the Core Area Liquid Waste Management Committee and CRD Board

4 Project Scope

This section summarises the scope delivered by the Project, as well as any variances in the delivered scope compared to that defined in the Business Case.

In furtherance of the Project's goal to minimize costs to residents and businesses, the Project Team undertook value engineering and reviewed the scope of each Project component in advance of commencing detailed design and initiating a competitive selection process to procure a construction contract. In some cases this value engineering led to the delivered scope exceeding that defined in the Business Case, and in some cases to the delivered scope being reduced from that defined in the Business Case.

Project Board approval was sought for variances in scope from the Business Case: CRD Board approval was not required as none of the variances resulted in any of the effects listed in CRD Core Area Wastewater Treatment Project Board Delegation Bylaw No. 1, 2016 (being: the Project not meeting provincial and federal regulations governing the Project, exceeding approved funding for the Project, or increasing costs to taxpayers from those stated in the Business Case).

4.1 McLoughlin Point Wastewater Treatment Plant

The McLoughlin Point Wastewater Treatment Plant can treat up to 108 megalitres of wastewater per day to a tertiary level, and discharge treated effluent into the ocean through a new outfall approximately 2km from shore and 60m deep.

The primary treatment process is the physical separation of solids from wastewater. Secondary treatment uses a biological process that removes dissolved and suspended organic compounds. During tertiary treatment wastewater passes through a 5 micron fabric disc filter, removing many pharmaceutical, hormones, microplastics and other contaminants from the discharged effluent.

Located at McLoughlin Point in Esquimalt, the McLoughlin Point Wastewater Treatment Plant is situated at the entrance of Victoria Harbour. Its appearance respects the setting and incorporates the highest standards of design, materials and aesthetics. It has been built to minimize visual impacts from the water and includes a multi-level green roof, mature landscaping, an observation deck, and a multi-use education space.

The McLoughlin Point Wastewater Treatment Plant's Operations and Maintenance building is designed to Leadership in Energy and Environmental Design (LEED) Gold standard and over 80% (or 1,600 m^2) of its roof is planted to increase on-site habitat and provide storm water management. A heat recovery system has also been incorporated: prior to discharge to the ocean, the effluent passes through heat exchangers which remove heat from the wastewater and use it to heat the Operations and Maintenance building at the facility.

The McLoughlin Point Wastewater Treatment Plant includes state-of-the-art odour control and a 24-hour odour control monitoring system. All treatment processing tanks are covered which result in one of the highest levels of odour capture and treatment in the industry. The odour control systems reduce odour emissions to a level not detectable by humans at the property line. The odour control system includes back-up odour control equipment and back-up power generators, reducing the possibility of odour escaping the facility if there is an equipment failure.

The McLoughlin Point Wastewater Treatment Plant has been designed for post-disaster operation in accordance with the 2012 British Columbia Building Code. The Code stipulates that post-disaster facilities must be designed to withstand the size or magnitude of earthquake that could occur once in every 2,475 year which translates approximately to a magnitude 6.5 earthquake. This means the facility will remain operational after a major earthquake, as well as other natural disasters, such as tsunamis.

The McLoughlin Point Wastewater Treatment Plant was designed and built by Harbour Resource Partners, as the design-build contractor. Harbour Resource Partners is a consortium of AECOM Canada and Graham Infrastructure.

Photographs of the McLoughlin Point Wastewater Treatment Plant are shown in Figures 1 and 2.

Figure 1 – Looking west at the McLoughlin Point Wastewater Treatment Plant

Figure 2 – Looking east over the McLoughlin Point Wastewater Treatment Plant

4.1.1 McLoughlin Point Wastewater Treatment Plant: Variance in Delivered Scope Compared to the Business Case

The McLoughlin Point Wastewater Treatment Plant delivered by the Project exceeds the scope defined in the Business Case in two key respects: the capability to increase the capacity of the plant (from 108 megalitres of wastewater per day to 124 megalitres per day), enabling it to accommodate population growth beyond 2040; and the capability to include effluent disinfection.

The Business Case required the McLoughlin Point Wastewater Treatment Plant to have the capacity to effectively accommodate the future population growth, and this was achieved: based on wastewater flow projections, the Plant has sufficient capacity to treat the core area's wastewater and accommodate regional population growth to at least 2040. In addition to that capacity, and providing a lifecycle cost benefit to the CRD, the Plant has been designed and built such that the capacity could be increased to accommodate population growth beyond 2040.

The Business Case required the McLoughlin Point Wastewater Treatment Plant to provide tertiary treatment, which it does. Disinfection of the treated effluent is not necessary to meet the regulatory requirements, and was not required by the Business Case. The Marine Environmental Impact Study undertaken for the Project by qualified professionals found that, based on extensive flow monitoring, hydraulic modelling and dispersion modelling, there would be little to no benefit to installing disinfection at this time. However, the McLoughlin Point Wastewater Treatment Plant has been designed to allow disinfection to be added at a future date if required. Specifically, after tertiary treatment, the treated effluent flows through dedicated channels which are sized to allow for the placement of ultraviolet equipment with minimal interruption to the operation of the Wastewater Treatment Plant. This configuration

allows for disinfection to be added, if desired at a later date, at a lower cost than if it had not been considered during Project delivery.

4.2 Residuals Treatment Facility

The Residuals Treatment Facility receives residual solids produced by the McLoughlin Point Wastewater Treatment Plant and processes them into Class A biosolids, the highest quality product suitable for beneficial use.

At the Residuals Treatment Facility residual solids undergo an anaerobic digestion process in which microorganisms break down biodegradable material in the absence of oxygen and produce biogas. The residual solids are then dewatered and heated to a very high temperature creating Class A biosolids.

The biogas produced during the digestion process is collected and reused within the facility as fuel for the dryer. The operations and maintenance building was designed and constructed in accordance with Leadership in Energy and Environmental Design (LEED) principles, and the process buildings incorporate sustainable design initiatives such as long-lasting building materials and water and energy efficiency.

All treatment processes are completed within closed containers and odour control systems are in place to ensure that there will be no discernible odour to residents once the commissioning phase is complete and the facility is fully-operational.

The Residuals Treatment Facility is located within the footprint of the Hartland Landfill. Key benefits of the Hartland Landfill location include:

- locating the Residuals Treatment Facility next to the existing, active landfill and within the footprint of the landfill allows for future integration between the region's solid waste and liquid waste management plans;
- the land is owned by the CRD;
- the land is not part of the Agricultural Land Reserve, park or ecological land reserve; and
- distance from residential neighbours.

The Residuals Treatment Facility has been designed for post-disaster operation in accordance with the 2012 British Columbia Building Code. The Code stipulates that post-disaster facilities must be designed to withstand the size or magnitude of earthquake that could occur once in every 2,475 year which translates approximately to a magnitude 6.5 earthquake. This means the facility will remain operational after a major earthquake.

The Residuals Treatment Facility was designed and built, and will be operated and maintained for twenty years by Hartland Resource Management Group, as the design-build-finance-operate-maintain contractor. Hartland Resource Management Group are a consortium comprising Synagro Capital, Maple Reinders PPP Ltd., and Bird Construction Inc.

Photographs of the Residuals Treatment Facility are shown in Figures 3 and 4.

Figure 3 – Looking southwest toward the Residuals Treatment Facility

Figure 4 – Looking east toward the Residuals Treatment Facility

4.2.1 Residuals Treatment Facility: Variance in Delivered Scope Compared to the Business Case

The Residuals Treatment Facility delivered by the Project exceeded the scope defined in the Business Case in a key respect (namely the ability to process and receive residual solids from other municipalities in addition to those from the Mcloughlin Point Wastewater Treatment Plant), and incorporated one of the scope elements through alternative means (being interim storage).

In furtherance of the Project's goal to provide value for money, the Project included a capital investment that exceeded the scope defined in the Business Case. The Residuals Treatment Facility was required to treat residuals solids produced by the McLoughlin Point Wastewater Treatment Plant. The Residuals Treatment Facility has been designed and constructed with the receiving facilities to enable it to also treat up to 3,100 kg/day of other municipal residual solids, while the Residuals Treatment Facility has surplus capacity (i.e. while the actual flow from the McLoughlin Point McLoughlin Point Wastewater Treatment Plant is less than the 2040 expected flow). This capital investment provides the CRD with a cost sharing and/or recovery option, and municipalities outside of the Core Area with a means to convert residual solids into a product capable of beneficial use.

Regarding interim storage, the Business Case anticipated the need to store the class A biosolids produced by the Residuals Treatment Facility at Hartland Landfill on an interim basis pending the introduction of an integrated resource management solution for all waste streams. The interim storage was to be configured with the ability to recover leachate and biogas.

To this end, after the CRD Board approved the Business Case (on September 14, 2016) the CRD submitted Amendment No. 11 to the Core Area Liquid Waste Management Plan to the Ministry of Environment (on September 16, 2016), inclusive of a biocell to store product on an interim basis to allow time for a long-term beneficial use option to be designed and implemented. On September 30, 2016 the Ministry of Environment provided conditional approval of Amendment No. 11, and on November 18, 2016 clarified the conditional approval. One condition of the clarified approval was the requirement that the CRD develop a definitive plan for the beneficial use of biosolids that did not incorporate multi-year storage of biosolids within a biocell.

The conditional approval therefore reduced the scope of the interim storage from that envisioned in the Business Case. The Project delivered the reduced scope through the following means:

i) recovery (and use) of biogas within the Residuals Treatment Facility: biogas produced during the treatment process is utilized as an energy source, making the facility thermally self-sufficient; and
ii) the inclusion of storage within the Residuals Treatment Facility, so as to allow for a period of five continuous days at 2040 maximum load conditions without offtake of any biosolids.

The Project Board approved this variance in scope from the Business Case necessitated by the Ministry's conditional approval: CRD Board approval was not sought as the alteration to the scope did not result in any of the effects listed in CRD Core Area Wastewater Treatment Project Board Delegation Bylaw No. 1, 2016 (being: the Project not meeting provincial and federal regulations governing the Project, exceeding approved funding for the Project, or increasing costs to taxpayers from those stated in the Business Case).

4.3 Conveyance System

4.3.1 Clover Point Pump Station

The Clover Point Pump Station was upgraded and expanded as part of the Wastewater Treatment Project. The original pump station was built in the 1970s and pumped wastewater directly into the ocean. The expanded pump station pumps wastewater from Victoria, Saanich, and Oak Bay to the McLoughlin Point Wastewater Treatment Plant for tertiary treatment, and provides bypass pumping to the existing outfall during storm events. Specifically, and in exceedance of the British Columbia Ministry of Environment's approval of Amendment 11 to the CALWMP (which required that primary treatment be guaranteed for Clover Point catchment flows of up to three times average dry weather flows[3]), the Clover Point Pump Station is capable of conveying four times the 2021 average dry weather flow of the Clover Point catchment to McLoughlin Point Wastewater Treatment Plant for treatment, and will convey storm flows in excess of that amount out of the Clover Point outfall.

In addition to pumping wastewater to the McLoughlin Point Wastewater Treatment Plant for treatment and providing bypass pumping during storm events, the Clover Point Pump Station functions as one of two headworks for the McLoughlin Point Wastewater Treatment Plant: all wastewater conveyed to the pump station is screened to remove stones, paper, cloth, plastics and other debris, and then passes through a grit removal system. The grit and screenings are compacted and trucked to the Hartland landfill.

The Clover Point Pump Station is underground and below the grade of the adjacent section of Dallas Road. The expanded facility has been constructed out of materials that allow it to blend with the existing facility and surrounding area. The pump station now includes upgraded odour and noise control features, such that there will be no discernible odour or noise to residents.

The Clover Point Pump Station has been designed for post-disaster operation in accordance with the 2012 British Columbia Building Code. The Code stipulates that post-disaster facilities must be designed to withstand the size or magnitude of earthquake that could occur once in every 2,475 year which translates approximately to a magnitude 6.5 earthquake. This means the facility will remain operational after a major earthquake, as well as other natural disasters, such as tsunamis.

The Clover Point Pump Station was designed and built by Kenaidan Contracting Limited, as the Design-Build Contractor.

As part of their scope of work, Kenaidan were also responsible for the construction of a number of public amenities, such as public washrooms, pedestrian and bicycle paths, bicycle facilities, a public plaza, street furniture and road intersection improvements.

Photographs of construction progress at Clover Point are shown in Figures 5 and 6.

[3] The average dry weather flow (ADWF) is the average daily flow during the dry weather season: the average dry weather season for the core area is from June 1 to August 31.

Figure 5 – Looking west towards Clover Point Pump Station (construction in progress)

Figure 6 – Entrance to the expanded Clover Point Pump Station
(construction in progress: public amenities and landscaping still to be completed)

4.3.1.1 Clover Point Pump Station: Variance in Delivered Scope Compared to the Business Case

The upgrade and expansion of the Clover Point Pump Station delivered by the Project exceeds the scope defined in the Business Case, which required an expansion to the existing pump station and the replacement of the storm pump motors in the existing station. As a result of considering lifecycle costs, the Project replaced the entire storm pumping system (rather than simply the storm pump motors) and replaced the odour control system with an improved two-stage system.

4.3.2 Clover Forcemain

The Clover Forcemain conveys wastewater from the Clover Point Pump Station to the McLoughlin Point Wastewater Treatment Plant for tertiary treatment. The Forcemain alignment is along Dallas Road from Clover Point to Ogden Point, where it connects to the Victoria cross-harbour undersea pipe. The pipe is 3.2km long and 1.2m in diameter.

The Clover Forcemain alignment was developed in collaboration with the City of Victoria and considered the protection of the Dallas Road bluffs, the location of mature trees and sensitive vegetation, and traffic impacts during construction.

The CRD constructed infrastructure improvements along the alignment of the Clover Forcemain to add value and enhance the livability of the surrounding neighbourhoods. This included a cycle path along the forcemain route, line painting, bike racks and plantings, four new crosswalks, pathway lighting, and a bike dismount area at the entrance to Clover Point.

The Clover Forcemain was constructed by Windley Contracting Ltd., as the Construction Contractor.

A photograph showing the cycle path constructed as part of the Clover Forcemain, and a map of the Clover Forcemain route, are shown in Figures 7 and 8, respectively.

Figure 7 – New cycle path amenity delivered with the construction of the Clover Forcemain

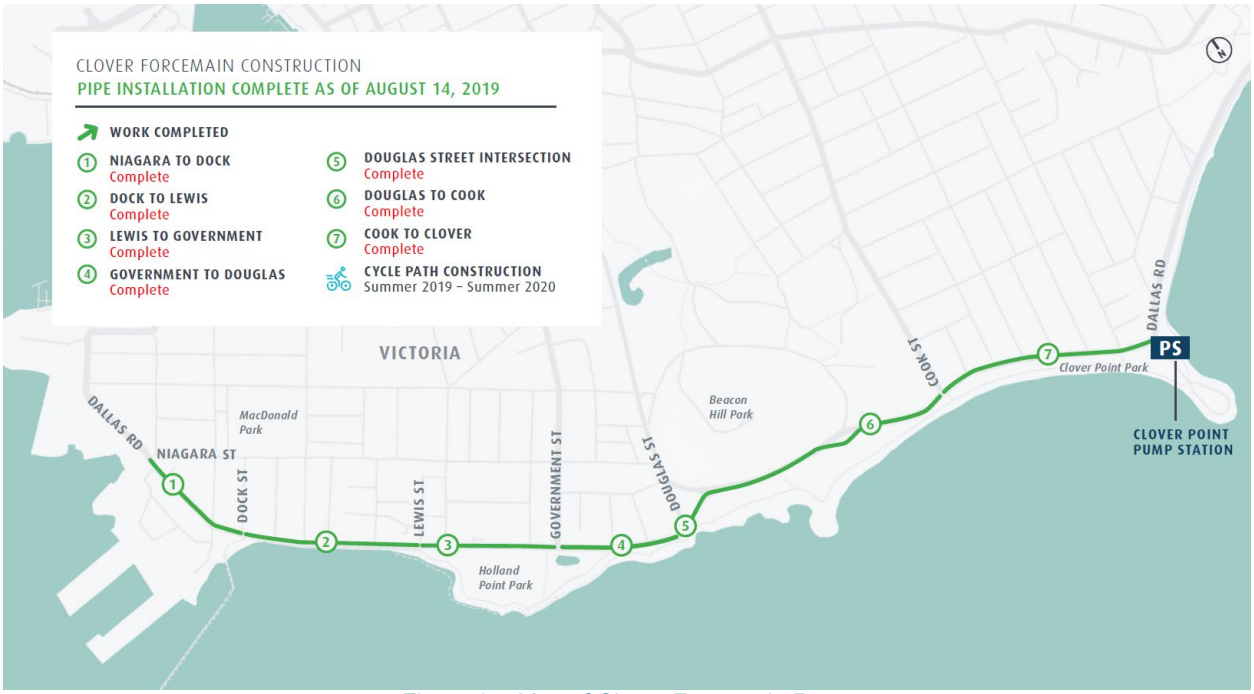

Figure 8 – Map of Clover Forcemain Route

4.3.2.1 Clover Forcemain: Variance in Delivered Scope Compared to the Business Case

The Clover Forcemain has been delivered as defined in the Business Case: there was no variance in the delivered scope compared to the Business Case.

4.3.3 Macaulay Point Pump Station and Forcemain

The new Macaulay Point Pump Station pumps wastewater from western core area municipalities and the Esquimalt and Songhees Nations to the McLoughlin Point Wastewater Treatment Plant for tertiary treatment. It was built to replace the original pump station that pumped wastewater directly into the ocean. The new Macaulay Point Pump Station will provide bypass pumping to the Macaulay Point outfall during heavy rainfall events. Specifically, the Macaulay Point Pump Station is capable of conveying six times the 2021 average dry weather flow[4] of the Macaulay Point catchment to McLoughlin Point Wastewater Treatment Plant for treatment, and will convey storm flows in excess of that amount out of the Macaulay Point outfall.

In addition to pumping wastewater to the McLoughlin Point Wastewater Treatment Plant for treatment and providing bypass pumping during storm events, the Macaulay Point Pump Station functions as one of two headworks for the McLoughlin Point Wastewater Treatment Plant: all wastewater conveyed to the pump station is screened to remove stones, paper, cloth, plastics and other debris. It is then put through a vortex grit removal system which uses centrifugal force to keep the organic material suspended while grit settles and is removed. The grit and screenings are compacted and trucked to the Hartland landfill.

The Macaulay Forcemain is a 1350mm diameter pipe that connects the Macaulay Point Pump Station to the McLoughlin Point Wastewater Treatment Plant.

The design of the pump station considers its location on the waterfront, greatly improving the visual impact of the building compared to the previous pump station, and creating a park-like amenity for the community to enjoy.

The new pump station is mostly below-grade with one storey above ground and a pitched roof that slopes towards the ocean. The design applies Leadership in Energy and Environmental Design (LEED) principles including a rain garden, native plants to reduce irrigation requirements, low-level lighting to minimize light pollution, and a green roof.

The Macaulay Point Pump Station has been designed for post-disaster operation in accordance with the 2012 British Columbia Building Code. The Code stipulates that post-disaster facilities must be designed to withstand the size or magnitude of earthquake that could occur once in every 2,475 year which translates approximately to a magnitude 6.5 earthquake. This means the facility will remain operational after a major earthquake, as well as other natural disasters, such as tsunamis.

[4] The average dry weather flow (ADWF) is the average daily flow during the dry weather season: the average dry weather season for the core area is from June 1 to August 31.

Landscaping has been used to integrate the building with the surrounding area. The design maximizes vegetation opportunities and landscape functionality: it has transformed what was an almost entirely impermeable lot into an environmentally-rich, park-like setting with public amenities.

The Macaulay Point Pump Station and Forcemain was designed and built by Kenaidan Contracting Limited, as the Design-Build Contractor.

Photographs of the Macaulay Point Pump Station are shown in Figures 9 and 10.

Figure 9 − Macaulay Point Pump Station

Figure 10 – Looking north towards the Macaulay Point Pump Station (construction in progress, landscaping still to be completed)

4.3.3.1 Macaulay Point Pump Station: Variance in Delivered Scope Compared to the Business Case

The Macaulay Point Pump Station delivered by the Project exceeds the scope defined in the Business Case, which required upgrades including improvements to the existing building and landscaping. As a result of considering lifecycle costs, rather than simply upgrade the existing pump station the Project replaced the existing Macaulay Point Pump Station.

The original Macaulay Point Pump Station was built in 1972 and would have required significant upgrades to allow it to continue to be safely operated as well as a significant expansion to allow it to pump wastewater to the McLoughlin Point Wastewater Treatment Plant.

The Project Team ran a competitive selection process for the design and build of the upgrade and expansion required to the Macaulay Point Pump Station, and selected a proposal that entailed demolition of the existing pump station and replacing it with a new pump station. This solution provides improved operating efficiency, and therefore lower operating and maintenance costs: investing in a new pump station as part of the Project, rather than paying to upgrade and maintain the existing pump station, provides better overall value to the CRD.

4.3.4 Craigflower Pump Station

The Craigflower Pump Station was delivered by the CRD between 2013 and 2015, before the Project Board were established.

The Craigflower Pump Station directs wastewater from View Royal, Colwood, Langford and Esquimalt, as well as Songhees and Esquimalt First Nations, to the Macaulay Point Pump Station. It replaced a previous pump station that was built in 1971, in order to increase the capacity of the conveyance system and prevent wastewater overflows into Portage Inlet.

The design incorporated Leadership in Energy and Environmental Design (LEED) principles including a rain garden, native plants to reduce irrigation requirements, low-level lighting to minimize light pollution, and windows designed to allow daylight in to minimize indoor lighting requirements.

The Craigflower Pump Station was built for post-disaster operation in accordance with the 2012 British Columbia Building Code. The Code stipulates that post-disaster facilities must be designed to withstand the size or magnitude of earthquake that could occur once in every 2,475 year which translates approximately to a magnitude 6.5 earthquake. This means the facility will remain operational after a major earthquake.

The Craigflower Pump Station was constructed by Jacob Bros. Construction Inc., as the Construction Contractor.

A photograph of Craigflower Pump Station is shown in Figure 11.

Figure 11 − Craigflower Pump Station

4.3.4.1 Craigflower Pump Station: Variance in Delivered Scope Compared to the Business Case

The Craigflower Pump Station was delivered by the CRD before the development of the Business Case: there was therefore no variance in the delivered scope compared to the Business Case.

4.3.5 Residual Solids Conveyance Line

The Residual Solids Conveyance Line includes two pipes and three small pump stations, to connect the McLoughlin Point Wastewater Treatment Plant to the Residuals Treatment Facility at Hartland Landfill.

The first pipe is 250mm in diameter and 19.3km long, and transports residual solids from the McLoughlin Point Wastewater Treatment Plant to the Residuals Treatment Facility for treatment. The second pipe is 300mm in diameter and 12.4km long, and returns the liquid removed from the residual solids during the treatment process at the Residuals Treatment Facility to the Marigold Pump Station. From there it is returned to the McLoughlin Point Wastewater Treatment Plant through the existing conveyance system.

The alignment was developed with the District of Saanich, Township of Esquimalt and City of Victoria based on technical, environmental, social, and economic considerations.

The three pump stations built along the route of the Residual Solids Conveyance Line pump the residual solids from the McLoughlin Point Wastewater Treatment Plant (which is at sealevel) to the higher elevation of the Residuals Treatment Facility. The pump stations are located within road rights of way. The locations of the pump stations were determined based on the grade of the route and flow rates, and accounted for community consultation.

The pump stations are designed with state-of-the-art odour control systems that contain and suppress odour so there is no discernible smell in the community. Landscaping features include a variety of trees, shrubs and ground coverings.

The Residual Solids Conveyance Line was constructed by:

- Don Mann Excavating Ltd., as the Construction Contractor for the Residual Solids Pipes; and
- Knappett Projects Inc., as the Construction Contractor for the Residual Solids Pump Stations.

A photograph of one of the Residual Solids Pump Stations (located along the Interurban Trail in Saanich) and a map of the Residual Solids Conveyance Line route are shown in Figures 12 and 13.

Figure 12 − Residual Solids Pump Station located along the Interurban Rail Trail in Saanich (Construction in progress, landscaping still to be completed)

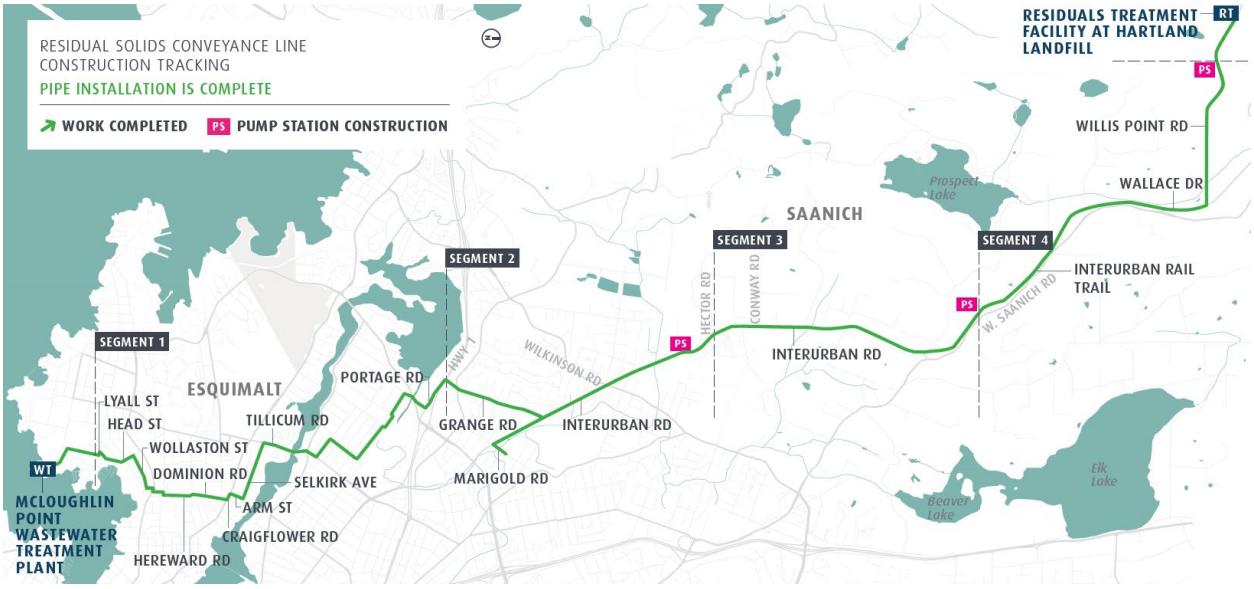

Figure 13 – Map of Residual Solids Conveyance Line Route

4.3.5.1 Residual Solids Conveyance Line: Variance in Delivered Scope Compared to the Business Case

The delivered Residual Solids Conveyance Line exceeds the scope defined in the Business Case. The Project designed and built the return Residual Solids Conveyance Line with sufficient capacity to convey leachate from Hartland Landfill - as well as centrate from the Residuals Treatment Facility – to Marigold Pump Station, from where it will be conveyed to the McLoughlin Point Wastewater Treatment Plant through the CRD's existing conveyance system.

While this increased the capital cost to the Project it provided significant value to the CRD, as the new pipe has been designed in accordance with seismic criteria, and compared to utilising the existing leachate pipe it has the following advantages: advanced monitoring, increased capacity and reliability.

4.3.6 Arbutus Attenuation Tank

The Arbutus Attenuation Tank is a 5,000m^3 underground concrete tank that temporarily stores wastewater flows during high volume storm events in order to reduce the number of sewer overflows. High volume storm events usually occur in the winter and during these events excess wet weather flows in the eastern portion of the conveyance system will be diverted into the Arbutus Attenuation Tank. The Arbutus Attenuation Tank will function in a similar manner to the Marigold attenuation tank in the western portion of the conveyance system. Once the high storm flow has passed, the tank will empty back into the existing sewer system to direct wastewater to the Clover Point Pump Station and then onto the McLoughlin Point Wastewater Treatment Plant for tertiary treatment.

Once the tank is emptied, an automatic cleaning system will be activated to clean the floors, walls and columns of the tank. CRD staff will inspect the tank after each use to ensure it is cleaned and that all wastewater has drained back into the sewer system. The temporary storage of wastewater will reduce the number of overflows and resultant impacts along the coastline. The tank will be kept under negative air pressure to draw air within the tank directly into an activated carbon absorber system that will contain and suppress potential odours.

The Arbutus Attenuation Tank is located in Haro Woods and the site will be planted with vegetation appropriate for the local woodland setting.

The Arbutus Attenuation Tank was constructed by NAC Constructors Ltd., as the Construction Contractor. As at May 2021, some minor construction and commissioning activities are required to complete this Project component, and it is expected to be operational in June, 2021.

A photograph of the Arbutus Attenuation Tank is shown in Figure 14.

Figure 14 – Arbutus Attenuation Tank
(Construction in progress)

4.3.6.1 Arbutus Attenuation Tank: Variance in Delivered Scope Compared to the Business Case

The Arbutus Attenuation Tank has been delivered as defined in the Business Case: there was no variance in the delivered scope compared to the Business Case.

4.3.7 Trent Forcemain

The section of Trent Forcemain delivered by the Project is an extension of the portion of forcemain constructed by the CRD in 2007 as part of the Trent Pump Station Project. The extension allows the Trent and Currie Pump Stations to operate at full design capacity: it increases the capacity of the eastern branch of the Capital Regional District's core area conveyance system (which collects wastewater from Saanich, Oak Bay, and Victoria, directing it to the Clover Point Pump Station), thereby reducing the number of wet weather overflows.

The Trent Forcemain is 2km of pipe installed from the intersection of Chandler Ave and St Charles Street to the Clover Point Pump Station. The Trent Forcemain consists of a section of 0.9m diameter pipe and a 1.5m diameter pipe.

The Trent Forcemain was constructed by Jacob Bros. Construction Inc., as the Construction Contractor.

A map of the Trent Forcemain route is shown in Figure 15.

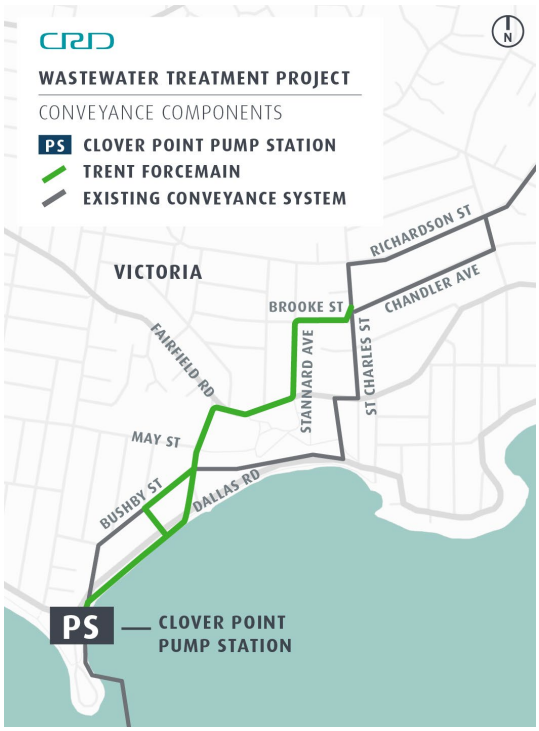

Figure 15 – Map of Trent Forcemain Route

4.3.7.1 Trent Forcemain: Variance in Delivered Scope Compared to the Business Case

The Business Case anticipated the need for upgrades to the conveyance system consistent with previous plans, which included the following four components:

- Capacity expansion of the Currie Pump Station;
- Twinning of the Currie Forcemain;
- Twinning of the East Coast Interceptor; and
- Extension of the Trent Forcemain.

These four components are shown in Figure 16. The need for these components was identified in 2004, and they were designed to convey excess wet weather flows to Clover Point, where they could be discharged out of the long outfall, rather than through a number of shorter outfalls in Oak Bay.

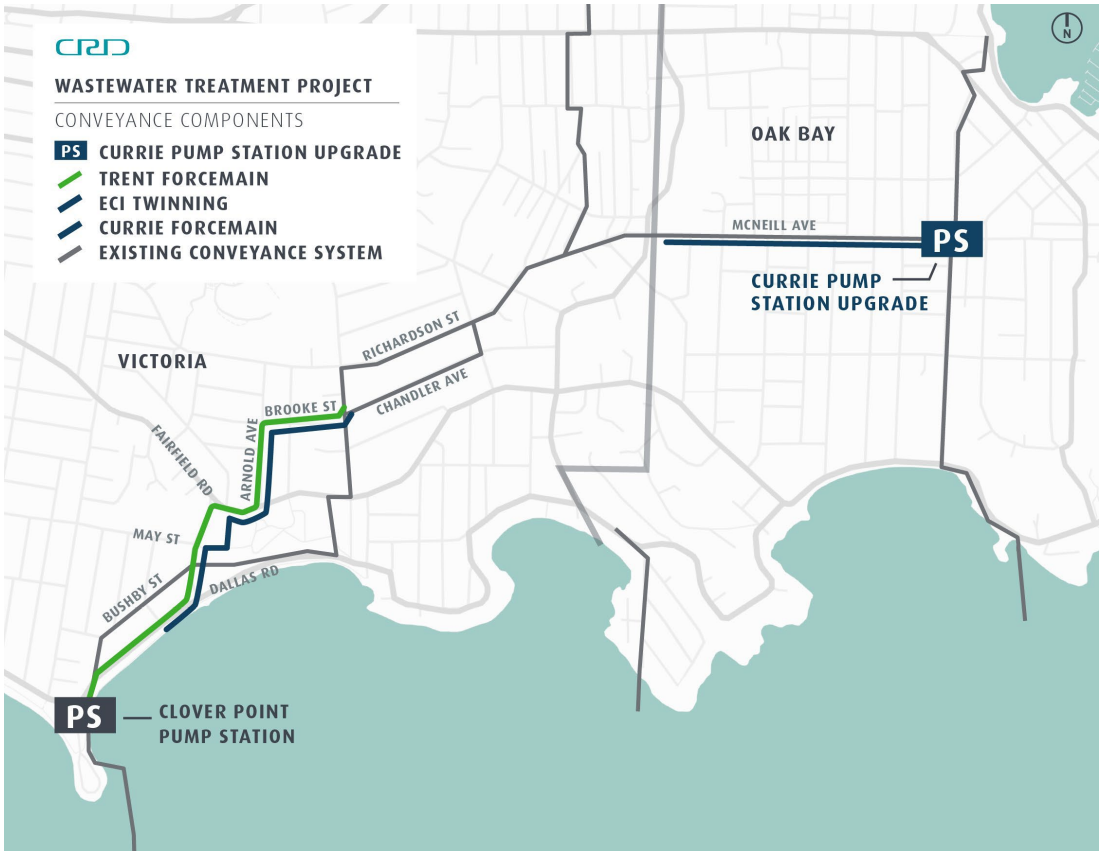

Figure 16 – Four Anticipated Components of the Conveyance Scope, as Identified in 2004

Over the last 15 years there were significant changes to factors influencing the need for these components including the availability of considerably more flow data that indicates a substantial reduction in water use per person. The Project therefore engaged the consulting engineering firm Kerr Wood Leidal to develop an updated model of the core area's wastewater system and assess the need for the components. This model will also be useful to the CRD outside of the Project as it will allow informed decisions to be made regarding capital investments required to meet future demands.

Based on extensive flow monitoring data and future wastewater flow estimates, KWL determined that only one of the remaining components (the extension of the Trent Forcemain) had any benefit and was required to meet federal and provincial regulations. Three components (capacity expansion of the Currie Pump Station, twinning of the Currie Forcemain, and twinning of the East Coast Interceptor) would not provide any benefit now, or in the future. Based on KWL's work, the Project Board approved refining the Project's scope to remove the three components that would provide no benefit to CRD residents.

The existing Currie Pump Station is still required to be operated for the core area wastewater system to function as intended, and as equipment reaches the end of its service life it will need to be rehabilitated or replaced. The CRD's Integrated Water Service Department is responsible for planning this work, and has included it in the current five-year capital plan for the core area wastewater system.

The Project Board approved this variance in scope from the Business Case: CRD Board approval was not sought as the alteration to the scope did not result in any of the effects listed

in CRD Core Area Wastewater Treatment Project Board Delegation Bylaw No. 1, 2016 (being: the Project not meeting provincial and federal regulations governing the Project, exceeding approved funding for the Project, or increasing costs to taxpayers from those stated in the Business Case).

4.4 Business Case: Scope Delivered Independently

The following items were included in the Business Case, however, either by jurisdiction or because of subsequent discussions, they were not within the scope of the Project or the Project Director's accountabilities:

- Advance studies for a wastewater treatment proposal in Colwood: provision for this was included in the Business Case but as a result of subsequent discussions between the CRD and Colwood a $2 million reserve has been established and funded by the Project's budget;
- Comprehensive planning and consultation process to develop a waste policy, including management of municipal solid and biosolid waste streams as part of an integrated resource management plan: this process is being led by the CRD outside of the Project; and
- The development of a multi-year capital plan to improve CRD sewage facilities to mitigate their impacts on host communities as part of the capital planning and project delivery progress. This process is being led by the CRD outside of the Project.

5 Project Performance Assessment

5.1 Achievement of Project Goals

As noted in Section 2.3, the Project Board's Terms of Reference included the following goals:

- Meet or exceed federal regulations for secondary treatment by December 31, 2020.
- Minimize costs to residents and businesses (lifecycle costs) and provide value for money.
- Optimize opportunities for resource recovery and greenhouse gas reduction.
- Deliver a solution that adds value to the surrounding community and enhances the liveability of neighbourhoods.

The Wastewater Treatment Project met all four of these goals, and the following sub-sections summarise the Project's performance against the goals.

5.1.1 Meet or exceed federal regulations for secondary treatment by December 31, 2020

The McLoughlin Point Wastewater Treatment Plant met and exceeded federal regulations when it commenced treating the Core Area's wastewater to a tertiary level before December 31, 2020.

Tertiary treatment is one of the highest levels of wastewater treatment available. For context:

- Two key regulated parameters for wastewater are total suspended solids (TSS) and carbonaceous 5-day biochemical oxygen demand (BOD_5);
- The Federal Wastewater Systems Effluent Regulations, which fall under the Fisheries Act, require the Core Area's wastewater to be treated such that the effluent discharged from the McLoughlin Point Wastewater Treatment Plant not exceed 25 mg/litre for those two key parameters (TSS and BOD_5); and
- The McLoughlin Point Wastewater Treatment Plant is capable of treating effluent such that those two key parameters (TSS and BOD_5) do not exceed, on average, 10 mg/litre.

Tertiary treatment was included in the Project as, during the development of the Business Case (which defined the scope of the Project), the Project Board concluded that there was a benefit to tertiary treatment for the following reason: the region places a high value on the environment and the public commentary suggested a widespread desire to do as much as is reasonably possible to treat the effluent, while recognizing cost implications.

The provision of tertiary treatment means that, in addition to treating the effluent such that it has lower TSS and BOD_5 than would be the case if the McLoughlin Point Wastewater Treatment Plant only met the federal regulatory requirements, more compounds of emerging concern, such as pharmaceuticals, hormones, microplastics and other contaminants are also removed from the effluent prior to discharge into the ocean.

5.1.2 Minimize costs to residents and businesses (lifecycle costs) and provide value for money

The Project met this goal through:

- identifying a cost effective Project scope and configuration;
- the capacity of the McLoughlin Point Wastewater Treatment Plant (which is sufficient to accommodate regional population growth) and its ability to: treat wastewater to a tertiary level, and add disinfection in the future if required;
- the execution of funding agreements for a significant portion (60%) of the Project's total cost;
- the use of competitive selection procurement processes for all construction contracts, to ensure competitive pricing was received, and the consideration of lifecycle costs in the evaluation of those procurements;
- the consideration of lifecycle costs during design development; and
- proactive risk management.

As part of the scoping of the Project, and as detailed in the Business Case, the Project Board evaluated a large number of options to identify a short list that best addressed the Project's goals. The Project Board developed detailed cost estimates for the short-listed options, ranked the short list using triple bottom line (economic, social and environmental) criteria, and identified the Project's scope and configuration as the best option to meet the Project goals and provide a sensible, cost-effective solution that was consistent with the views expressed by CRD residents.

Several design elements were included to allow the McLoughlin Point Wastewater Treatment Plant to meet the region's future capacity and treatment requirements more cost-effectively than if the Plant was to be retrofitted at a later date:

- Based on wastewater flow projections, the McLoughlin Point Wastewater Treatment Plant has been built with sufficient capacity to treat the core area's wastewater and accommodate regional population growth to at least 2040, and the Plant has been designed and built such that the capacity could be increased to accommodate population growth beyond 2040.

- The inclusion of tertiary treatment exceeds the current regulatory requirements. There are many compounds of emerging concern that are currently unregulated, but are being researched and may become regulated in the future. The provision of tertiary treatment at the McLoughlin Point Wastewater Treatment Plant means that it has the capability to meet more stringent regulations than exist today.

- The Plant has been built with the flexibility to add ultra-violet disinfection treatment to the process in the future if desired. While disinfection is not included in the Plant at this time (see section 4.1.1 for information regarding why there would be little to no benefit to installing disinfection at this time), building the Plant with the space for disinfection allows for it to be more cost-effectively added in the future if required.

After the CRD Board approved the Project's scope and configuration, funding agreements were executed with the federal and provincial governments, providing funding for 60% of the Project's budget. Table 3 summarises the total committed funding, and the funding received to-date. Note that the timing for the provision of Government of British Columbia and Government of Canada's funding differs by funding source. The Project Team have, and the CRD will continue to, submit claims to the funding partners in accordance with the relevant funding agreements. In accordance with the funding agreements, the remainder of the funding cannot be claimed until the Residuals Treatment Facility obtains service commencement.

Table 3 - Project Funding

Funding Source	Funding Received To-Date	Total Funding Committed
Government of Canada (Building Canada Fund)	$120M	$120M
Government of Canada (Green Infrastructure Fund)	$45M	$50M
Government of Canada (P3 Canada Fund)	-	$41M
Government of British Columbia	$186M	$248M
Federation of Canadian Municipalities	-	$0.3M
Total Federal and Provincial Funding	**$351M**	**$459.3M**

Competitive selection procurement processes were used for all construction contracts. These were advertised on BC Bid and open for participation by any interested party to ensure competitive pricing was received. In addition, lifecycle costs were factored into the evaluation of proposals received in response to competitive selectin processes. Some examples of factoring lifecycle costs into procurement evaluations include:

- Residuals Treatment Facility: the evaluation was based on the total cost to the CRD (inclusive of the estimated costs of transporting and beneficially-using the biosolids produced by the Residuals Treatment Facility) rather than just that portion to be funded by the Project (being the capital cost of constructing the facility).
- Replacement of the existing Macaulay Point Pump Station: the Project scope approved in the Business Case included an upgrade to the existing Macaulay Point Pump Station - to include a new building and alterations to the existing building. The original Macaulay Point Pump Station was built in 1972 and would have required significant upgrades to allow it to continue to be safely operated as well as a significant expansion to allow it to pump wastewater to the McLoughlin Point Wastewater Treatment Plant. The Project Team ran a competitive selection process for the design and build of the upgrade and expansion required to the Macaulay Point Pump Station, and selected a proposal that entailed demolition of the existing pump station and replacing it with a new pump station. This solution provides improved operating efficiency, and therefore lower operating and maintenance costs: investing in a new pump station as part of the Project, rather than paying to upgrade and maintain the existing pump station, provides better overall value to the CRD.
- Clover Point Pump Station: the evaluation accounted for the life cycle costs associated with the proponent's design solution, including the forecast cost of powering, operating, maintaining and replacing certain systems, equipment and portions of the pump station.

Throughout the design development and delivery of each Project component, lifecycle costs were factored into decisions. Some examples of lifecycle costs driving design decisions include:

- The replacement of the Macaulay inlet sewer: the original design was based on utilizing the existing inlet sewer to convey wastewater to the new pumping station. When the inlet sewer was exposed it was clear that corrosion had degraded the integrity of the pipe to the point where it could no longer be utilized. Options were

developed and evaluated on the basis of their construction cost and value to the CRD, and the replacement of the inlet sewer was selected as the option that minimized the lifecycle cost.

- Adding the capability to clean the Clover inlet channel: construction of the Clover Point Pump Station revealed substantive debris build-up in the inlet channel, from years of operations. Project funds have been committed to install infrastructure that will allow the CRD to clear debris from the inlet channel as needed.
- Capital investment at the Residuals Treatment Facility, to enable it to treat other municipal residual solids: while not part of the base scope of the Project (as defined in the Business Case), the inclusion of receiving facilities at the Residuals Treatment Facility provides value to the CRD as it allows the Residuals Treatment Facility to treat up to 3,100 kg/day of liquid and dewatered residual solids, while the Residuals Treatment Facility has surplus capacity (i.e. while the actual flow from the McLoughlin Point Wastewater Treatment Plant is less than the 2040 expected flow). This capital investment provides the CRD with a cost sharing and/or recovery option.
- Building the return Residual Solids Conveyance Line with sufficient capacity to convey leachate from Hartland Landfill - as well as centrate from the Residuals Treatment Facility – to Marigold Pump Station, from where it will be conveyed to the McLoughlin Point Wastewater Treatment Plant through the CRD's existing conveyance system: while this significantly-increased the capital cost borne by the Project it provided significant value to the CRD, as it allowed for: the existing line to be decommissioned, and provided a new line with increased capacity and lower maintenance costs.

Risk management on the Project involved the identification, analysis, oversight, management and monitoring of the Project risks. Project risks were reported monthly, and by proactively managing these risks the Project was able to address risks in a cost-effective way throughout the delivery of the Project. This was supported by the findings of Ernst and Young when they conducted an independent project execution review part-way through Project delivery (in April 2019), and reported:

- a strong risk-aware culture that was supported by well-defined processes and risk registers;
- the Project Team had put careful consideration into risk transfer when structuring contracts. Notable and leading industry practices around controlling mechanisms are in place, including incentive and penalty clauses; and
- Project reporting to be comprehensive and forward-looking, with commentary to provide the necessary context around key items.

5.1.3 Optimize opportunities for resource recovery and greenhouse gas reduction

The Project met this goal by:

- considering environmental implications when defining the Project's scope and configuration: the configuration of the Project was selected from a shortlist of options using a triple bottom line approach (economic, social and environmental). The

environmental aspect of this approach rated options based on the carbon footprint and potential for resource recovery; and

- constructing Project facilities with the following features:
  - the operations and maintenance building at the McLoughlin Point Wastewater Treatment Plant was built to the level of LEED (Leadership in Energy and Environmental Design) Gold, providing energy and water consumption reductions that exceed building code requirements. Some of the design features that contributed to the operations and maintenance building being built to the level of LEED Gold are:
    - the heat recovery system: prior to discharge to the ocean, the effluent passes through heat exchangers which remove heat from the wastewater and use it to heat water which is in turn circulated throughout the building to air handling units, and unit heaters, to heat the operations and maintenance building.
    - a green roof covering 80% of the operations and maintenance building (over 1,600 m^2) increases onsite habitat, provides stormwater management and contributes to reducing the heat island effect.
  - at the Residuals Treatment Facility:
    - the operations and maintenance building was designed and constructed in accordance with Leadership in Energy and Environmental Design (LEED) principles,
    - the process buildings incorporate sustainable design initiatives such as long-lasting building materials and water and energy efficiency
    - biogas produced during the treatment process is captured and utilized as an energy source, making the facility thermally self-sufficient.
  - the design of the Macaulay Point pump station incorporates LEED principles and sustainable design elements, such as:
    - rainwater run-off control using a rain garden and storm water management system;
    - the use of native plants to reduce irrigation requirements;
    - low-level lighting to minimize light pollution; and
    - green roof and increased open space.

5.1.4 Deliver a solution that adds value to the surrounding community and enhances the livability of neighborhoods

The Wastewater Treatment Project met this goal through working with the Township of Esquimalt, the City of Victoria, the District of Saanich, the Esquimalt and Songhees Nations, the Greater Victoria Harbour Authority and the Department of National Defence to identify amenities and/or infrastructure improvements that were either funded by the Project, or funded and delivered by the Project.

All Project components have also been designed to minimize their impacts on their host communities, including through the inclusion of advanced odour treatment such that there is no detectable odour by residents.

5.1.4.1 Township of Esquimalt

As part of the Host Community Impact 5-year Agreement the CRD has provided $17 million to the Township of Esquimalt, with:

- $7 million to be used for the improvement of waterfront parks;
- $5 million to be used for the improvement of public space within recreational facilities; and
- $5 million to be used for the construction, addition or improvement of emergency services and public safety facilities within the Township.

The delivered Project scope also considered the appearance of CRD wastewater facilities and the addition of neighbourhood amenities and public space improvements, including:

- Situated at the entrance of Victoria Harbour, the design of the McLoughlin Point Wastewater Treatment Plant respects the setting and incorporates the highest standards of design, materials and aesthetics. The design includes a multi-level green roof, mature landscaping, observation deck, and education space.
- The Macaulay Point Pump Station was designed to reflect its location on the waterfront and integrate it into the surrounding area. It transformed an almost entirely impermeable lot into an environmentally-rich, park-like setting with public amenities for the community to enjoy.

5.1.4.2 City of Victoria

Public space improvements were made by the Project as part of constructing the Clover Point Pump Station and the Clover Forcemain. Delivered improvements fully-funded by the Project included:

- At Clover Point: a public plaza, public washroom, bicycle facilities and drinking fountains; and
- Along the route of the Clover Forcemain: a multi-use path, benches, wayfinding signage, new sidewalks, and intersection improvements.

In addition to the above improvements that were fully-funded by the Project, the Project Team worked with the City of Victoria to incorporate streetscape improvements that were funded by the City and delivered by the Project's contractor more cost-effectively and with less construction impacts to residents than would otherwise have been possible.

5.1.4.3 District of Saanich

A land exchange was organized with the District of Saanich which added 2.8 hectares of land to Saanich's park inventory and secured the long-term preservation of the vast majority of Haro Woods. It also allowed the Arbutus Attenuation Tank to be installed on lands that were already partially cleared and previously disturbed. A blanket easement was also granted to the District of Saanich to allow for recreational use of the Arbutus Attenuation Tank site which will be planted with vegetation considering the local woodland setting following construction.

Funding will also be provided to the District of Saanich for infrastructure improvements including a new bike lane, sidewalk, and storm water management improvements along Arbutus road, next to the Arbutus Attenuation Tank, as well as providing traffic calming measures and pedestrian connectivity in neighbourhoods along the Residual Solids Conveyance Line.

As part of the work for the Residuals Treatment Facility, improvements were made to the level of water service to properties in the vicinity of the Hartland Landfill.

5.1.4.4 Songhees and Esquimalt Nations

Support agreements were signed with the Songhees and Esquimalt Nations, providing a number of benefits, including the provision of funding to assist in the upgrading and development of the Westbay Marine Village Marina and R.V. Park. The CRD also worked with the Songhees and Esquimalt Nations to procure Indigenous art for display outside the Macaulay Point Pump Station. Further context is provided in sections 2.2 and 5.2.4.1 of this report.

5.1.4.5 Greater Victoria Harbour Authority

After installing a portion of the Clover Forcemain within land owned by the Greater Victoria Harbour Authority (GVHA) and using a plot of GVHA's land as a temporary staging area for the Project, the Project worked with the GVHA to discuss how the land should be restored. After the GVHA reviewed and approved the restoration plan for this location the Project restored the land to a condition that met their needs, which included planting grass and installing a gravel parking lot.

5.1.4.6 Department of National Defence

Temporary laydown areas were put in place on several parcels of land owned by the Department of National Defence (DND). Restoration of this land was completed in consultation with DND staff and the Project implemented identified improvements including: the construction of a new fenced and lit storage yard; improvements to the fencing and grading at the community garden; planting of boulevard trees to provide shade to resident housing and improvements to staff parking areas near Macaulay Point.

5.2 Key Performance Indicators Dashboard

As established in the Project Charter, the realization of the Project's vision and goals was monitored against the Project's key performance indicators, and the Project Director reported performance against these key performance indicators to the Project Board on a monthly basis. The key performance indicators at Project Completion have been assessed to be as shown in Table 4, and as described in the following sub-sections of this report.

Table 4 – Status of Key Performance Indicators at Project Completion

Key Performance Indicators		Project Overall	Comments
Safety	Deliver the Project safely with zero fatalities and a total recordable incident frequency (TRIF) of no more than 1*.		As of May 2021, the vast majority of construction has been completed (the Arbutus Attenuation Tank and Clover Point Pump Station are the only Project sites with some minor construction activities remaining), there have been zero fatalities and the TRIF was 1.5. While this exceeds the Project's ambitious target of no more than 1, it was less than half the industry average: WorkSafe BC records the TRIF for various industries, and for 2018 (the most recent year for which information has been published) the TRIF for heavy construction was 3.2. See section 5.2.1.
Environment	Protect the environment by meeting all legislated environmental requirements and optimizing opportunities for resource recovery and greenhouse gas reduction.		The Project met all legislated environmental requirements and, through the design of the various components optimized opportunities for resource recovery and greenhouse gas reduction. Over the course of construction there were a relatively small number of environmental incidents: they were all diligently-managed, appropriately-reported and mitigated as required, with the result that there weren't any long-term impacts. An unexpectedly-significant environmental benefit of the Project included the remediation of McLoughlin Point. See section 5.2.2 for further information.
Regulatory Requirements	Deliver the Project such that the Core Area complies with provincial and federal wastewater regulations.		Through the addition of the Project components to the core area wastewater system, the system can be operated in compliance with provincial and federal wastewater regulations. See section 5.2.3 for further information.
Stakeholders	Continue to build and maintain positive relationships with First Nations, local governments, communities, and other stakeholders.		Significant efforts were made to engage with and provide accurate and timely information to stakeholders throughout the delivery of the Project. Through these efforts and the achievement of the Project's goals, positive relationships were built and maintained with First Nations, local governments, communities, and other stakeholders. See section 5.2.4.
Schedule	Deliver the Project by December 31, 2020.		The Project completed the majority of construction by December 31, 2020, and achieved its schedule-related goal, which was to meet or exceed federal regulations for secondary treatment of wastewater by December 31, 2020. All aspects of the Project that were required to meet the regulatory requirements were delivered by December 31, 2020. As of May 2021, commissioning of the Residuals Treatment Facility is ongoing and is anticipated to be complete in June 2021, and the Arbutus Attenuation Tank and Clover Point Pump Station are the only Project sites with some minor construction activities remaining. See section 5.2.5 for further information.
Cost	Deliver the Project within the Control Budget ($765 million).		While the total Project cost will not be known until total completion of all contracts, which is anticipated to occur in the last quarter of 2021, it is forecast that the total Project cost will be approximately $766.7M, which is within the approved budget of $775M. The total Project cost is therefore forecast to exceed the Project's Control Budget (of $765M) by 0.2%, but be well within the budget subsequently-approved by the CRD Board (of $775M). See Section 5.2.6 for further information.

* A TRIF of no more than 1 means that there is 1 or fewer recordable incidents (being a work-related injury or illness that requires medical treatment beyond first aid or causes death, days away from work, restricted work or transfer to another job, or loss of consciousness) for every 200,000 person-hours of work

Status	Description
	Significant adverse effect of KPI not being met
	KPI not met but outcome managed
	KPI achieved

5.2.1 Safety

Safety was the Project's top priority: safety of the public, construction workers and CRD staff, including those responsible for delivery of the Project and for its ongoing operation and maintenance.

The Project's safety key performance indicator was to deliver the Project safely with zero fatalities and a total recordable incident frequency (TRIF) of no more than 1. A TRIF of no more than 1 is an ambitious target that means that there is 1 or fewer recordable incidents (being a work-related injury or illness that requires medical treatment beyond first aid or causes death, days away from work, restricted work or transfer to another job, or loss of consciousness) for every 200,000 person-hours of work.

Safety information for the Project is summarised in Table 5 for the period up to May 2021, at which time the vast majority of construction was complete (the Arbutus Attenuation Tank and Clover Point Pump Station are the only Project sites with some minor construction activities remaining), there have been zero fatalities and the TRIF was 1.5. While this exceeds the Project's ambitious target of no more than 1, it was less than half the industry average: WorkSafe BC records the TRIF for various industries, and for 2018 (the most recent year for which information has been published) the TRIF for heavy construction was 3.2.

Table 5: Project Safety Information

	Project Total
	Person Hours (Sept 2016 – May 2021)
Project Management Office Hours	171,264
Project Contractor Hours	2,364,950
Total Person Hours	2,536,222
	Number of Incidents (Sept 2016 – May 2021)
Near Miss Reports	49
High Potential Near Miss Reports	7
Report Only	190
First Aid	69
Medical Aid	12
Medical Aid (Modified Duty)	2
Lost Time	5
Total Recordable Incidents	19
	Project Frequency (from January 1, 2017)
First Aid Frequency	5.4
Medical Aid Frequency	1.1
Lost time Frequency	0.4
Total Recordable Incident Frequency	1.5

The responsibility for safety on each of the Project sites was delegated to a prime contractor (being the contractor for that Project site) under section 118 of the Workers Compensation Act (British Columbia). Each prime contractor was required to designate a site safety representative and submit site safety management and traffic management plans for the Project Team's review prior to commencing construction.

The Project Team validated that each contractor met their safety requirements through a robust oversight and audit program. The Project Team continued to emphasise the importance of safety to every prime contractor, including through:

- mandating and participating in hazard and operability safety reviews during design progression;
- reviewing and commenting on design submittals considering safety impacts;
- reviewing and commenting on contractors' safety and traffic management plans;
- monitoring contractors' performance for conformance to their safety and traffic management plans; and
- reviewing the prime contractors' and their subcontractors' safety performance.

In addition, while the Project Team understood that, although the responsibility for safety on each Project site was delegated to a prime contractor, safety remains everybody's responsibility at all times, and maintained a strong safety-first culture throughout the delivery of the Project.

The Project Team believe that the ambitious TRIF target, focus on safety as the Project's top priority, and commitment to continuous improvement in safety management resulted in the Project being delivered more safely than would otherwise have been the case. The effectiveness of this focus was demonstrated by the independent review of the Project's safety management system, conducted by Allman Safety part-way through Project delivery in April 2019, which found that:

- There was strong and obvious commitment from senior management to remove or minimize risk in the workplace.
- The Safety Management System meets or exceeds industry health and safety standards and regulatory requirements.
- Prime contractor safety programs have improved under the direction of the project team to be complete and compliant.
- The communication strategy for safety improvement from contractors to the project team and from the project team to the contractors is both electronic and verbal and is effective in both directions.
- There is evidence that the organization has continuing strategies to reduce unsafe conditions.
- Leading and lagging indicators are reported and reviewed to focus attention on target areas.
- There has been continuous improvement in safety response by contractors, with still more room for improvement.

5.2.2 Environment

The Project's environment key performance indicator was to protect the environment by meeting all legislated environmental requirements and optimizing opportunities for resource recovery and greenhouse gas reduction.

The Project met this key performance indicator: see Section 5.1.3 for how the Project optimized opportunities for resource recovery and greenhouse gas reduction; the Project also protected the environment by meeting all legislated environmental requirements.

The Project Team's approach to environmental and regulatory management was multi-faceted and included activities during design, procurement and construction, including:

- Preparing Environmental Impact Studies, to inform the design and configuration of the Project in order to minimise environmental impacts at the outset, and to identify mitigation measures to reduce potential environmental impacts;
- Designing the Project to ensure the scope meets: legislative requirements, approval conditions, and incorporates Leadership in Energy and Environmental Design (LEED) or equivalent principles, as applicable;
- Retaining an archaeological advisor to provide advice and assistance with respect to archaeological management for the Project as a whole;
- Including robust environmental protection, monitoring and reporting requirements in construction contracts, including the requirement for each contractor to appoint a qualified professional to monitor the contractor's compliance with environmental laws, environmental aspects of applicable permits, archaeological protection, and contaminated soil management;
- Reviewing contractors' environmental management plans, environmental protection plans and regulatory approval plans – both upon initial submission and as construction progresses to ensure that the plans remain valid and are updated as warranted by, for example, the introduction of new work methods or regulatory requirements; and
- Auditing contractors' environmental performance, including through:
    - The review of any environmental incidents to confirm the accuracy and sufficiency of reporting, to discuss "lessons learned", and to go over how corrective actions are implemented;
    - conducting site tours and monitoring contractors' construction activities to confirm contractors are following their environmental protection plans; and
    - conducting periodic meetings with contractor's site and environmental representatives to review environmental performance.

This approach was effective in protecting the environment throughout the course of construction – which occurred at over 26 active work sites - as evidenced by the fact that there were a relatively small number of environmental incidents, and they were all diligently-managed, appropriately-reported and mitigated as required, with the result that there weren't any long-term impacts.

Most environmental incidents were minor in nature and did not result in any impacts on the environment. A typical example would be a low-volume release of hydraulic fluid as a result of equipment breakage, with the release being immediately contained.

Three environmental incidents occurred that were more significant and had the potential to have adverse effects, but the rapid implementation of appropriate mitigative action and oversight by environmental professionals avoided any significant long-term impacts:

- In November 2018, Vancouver Pile Driving, a subcontractor to Harbour Resource Partner (Harbour Resource Partners, the Design-Build Contractor for the McLoughlin

Point Wastewater Treatment Plant) towed a scow loaded with material dredged as part of the construction of the McLoughlin Point Wastewater Treatment Plant outfall to Bamberton in the Saanich Inlet. The scow was towed to Bamberton as the dredged material was previously identified as contaminated (from activities unrelated to the Project) and there is a suitable disposal site near Bamberton. The scow was tied up for the night and the following morning the starboard stern corner of the scow was observed to be listing heavily. Van Pile notified Harbour Resource Partners, the Coast Guard and Provincial Emergency Management Program. The Coast Guard arrived on site that morning and deployed containment booms around the scow. Van Pile initiated activities to right the scow and by the morning of November 16, 2018 the scow was floating safely and crews offloaded the remaining dredged material. The Coast Guard returned that morning and removed the containment booms. Coast Guard and Transport Canada investigations determined that no hydrocarbons were released to the environment during the incident, and Van Pile determined that no dredged material entered the water. Harbour Resource Partners' qualified environmental professionals took water samples on November 15 and 16, 2018 to assess potential effects on water quality. They determined that inside of the containment boom the incident resulted in Provincial Water Quality standards for turbidity and total suspended solids being exceeded for a period of less than 24 hours. Outside of the containment boom there were no water quality guideline exceedances. The Province determined that the incident was not reportable, and Harbour Resource Partners' qualified environmental professionals determined that there were no adverse environmental impacts from the incident.

- In August 2019, Knappett (the Construction Contractor for Residual Solids Pump Stations), was preparing to install the Residual Solids Conveyance Line under the Colquitz Creek and experienced challenges with dewatering and isolation of the work area, leading to sediment releases that resulted in short-term increases in turbidity. The sediment releases were reported to federal and provincial authorities and instream work was temporarily-suspended while the construction plan was revised. The water quality remained within BC Water Quality Guidelines, and due to the short duration of the turbidity increases, Knappett's qualified environmental professional determined it is unlikely that there were any adverse effects on fish or fish habitat. In September once the new plan was implemented, work resumed and a different isolation methodology was employed, allowing the Residual Solids Conveyance Line to be installed successfully. Prior to placement of spawning gravel and completion of backfilling, a large rain event resulted in the isolated work area being inundated. In response, Knappett removed the isolation dams, as they were no longer required to finish the work. The inundation and dam removal also led to sediment releases that created short-term turbidity increases, but again, water quality remained within BC Water Quality Guidelines, and due to the short duration of the turbidity increases, Knappett's qualified environmental professional determined it was unlikely that there were any adverse effects on fish or fish habitat The instream work was completed without further incident, and restoration and stream enhancement work conducted. This included placement of spawning gravel, removal of invasive plant species and planting of native riparian vegetation. The stream enhancement was successful, and Coho spawners have been observed using the installed spawning gravel.

- In October 2020, there was a release of residual solids at the Residuals Treatment Facility site. A temporary pipe failed during the commissioning process. Some of the

residual solids were contained on-site (within Hartland Landfill) but some travelled through a culvert and collected in a nearby low area in the CRD's Mount Work Regional Park. The release was reported to Emergency Management BC, in accordance with the Spill Reporting Regulation. Qualified environmental professionals assessed the affected area and provided oversight over remediation activities, including on the appropriate monitoring and testing protocols. It was determined that there was no surface flow to Durrance Lake but samples were taken as a precaution: microbiological indicators in the samples were present at consistent or slightly lower levels than prior to the incident, demonstrating that the release did not impact Durrance Lake.

The fundamental purpose of constructing the Project was to treat the core area's wastewater prior to its discharge into the marine environment, thereby reducing pollution in the Strait of Juan de Fuca and contributing to the overall health of aquatic ecosystems in the area.

In addition to the fundamental environmental benefit of constructing the Project, an unexpectedly-significant environmental benefit of the Project was the remediation of McLoughlin Point. The McLoughlin Point site was contaminated as a result of its previous use as an oil tank farm. As part of the Project a significant amount of contaminated materials were removed from the site (and disposed of in regulated landfills), and the site was remediated to meet the applicable standards set by the Environmental Management Act ("EMA") and the Contaminated Sites Regulation ("Regulation") - as documented by the Certificate of Compliance issued by the Province.

5.2.3 Regulatory Requirements

The Project's regulatory requirements key performance indicator was to deliver the Project such that the Core Area complies with provincial and federal wastewater regulations.

The Project met this key performance indicator: see Section 5.1.1 for how the Project exceeded federal wastewater regulations; the delivered Project also complies with provincial wastewater regulations, as demonstrated by the registration of the Project under the Municipal Wastewater Regulation.

For further context, the provincial regulations comprise two main elements:

- Effluent quality requirements for treated wastewater discharged out of McLoughlin Point outfall, which the Project enables the CRD to meet through the provision of tertiary treatment at the McLoughlin Point Wastewater Treatment Plant; and
- The circumstances under which untreated wastewater can be discharged out of the core area's other outfalls, which the Project enables the CRD to meet through the Project components that expand the existing conveyance capacity (namely the construction of the Trent Forcemain and Arbutus Attenuation Tank). For context, in addition to the McLoughlin Point outfall (a new, 2km-long outfall built as part of the Project), the core area wastewater system includes a number of outfalls and overflow locations that are utilised in wet weather events. The provincial regulation requires that an overflow must not occur during storm or snowmelt events with a return period of less than five years, other than, as allowed by the Core Area Liquid Waste Management Plan.

The addition of the Project components to the core area wastewater system means that, based on current wastewater flow projections:

- The McLoughlin Point Wastewater Treatment Plant has sufficient capacity to treat the core area's wastewater and accommodate regional population growth to at least 2040; and
- The conveyance system has sufficient capacity to meet and exceed the following Core Area Liquid Waste Management Plan (CALWMP) commitments past 2045:
    - all wet weather flows up to four times the average dry weather flow (4 x ADWF) from the Macaulay Point catchment will be conveyed to McLoughlin Point for treatment;
    - all wet weather flows up to 3 x ADWF from the Clover Point catchment will be conveyed to McLoughlin Point for treatment;
    - no overflows will occur for a wet weather event with less than a 100-year return period at any of the high sensitivity receiving waters along the East Coast (i.e. Broom Road or Bowker Creek); and
    - no overflows will occur for a wet weather event with less than a 5-year return period at any of the receiving waters along the East Coast (i.e. Finnerty and McMicking Points), with the exception of those associated with the combined sewer system.

Note that there will continue to be overflows at Humber and Rutland. These overflows occur as portions of the collection system in Oak Bay have combined sewer systems that carry both sanitary (municipal wastewater) and storm flows. The Project was not scoped to reduce these overflows: Amendment No. 12 to the CALWMP – which entails undertakings independent of the Project - is intended to address this.

5.2.4 Stakeholders

The Project's stakeholders key performance indicator was to continue to build and maintain positive relationships with First Nations, local governments, communities, and other stakeholders. Significant efforts were made to engage with and provide accurate and timely information to stakeholders throughout the delivery of the Project. Through these efforts, which are summarised in the following subsections, and the achievement of the Project's goals, positive relationships were built and maintained with First Nations, local governments, communities, and other stakeholders.

5.2.4.1 First Nations

As outlined in section 2.2 of this report, the Core Area lies within or near the traditional territories of 16 First Nations. The CRD has been engaged in consultations with First Nations relating to wastewater treatment since 2006, and in relation to the Project since 2014.

The First Nations most closely associated with the Project are the Esquimalt and Songhees, historically known as the "*Lekwungen"*. Their communities are located in the Core Area within several kilometres of the McLoughlin Point Wastewater Treatment Plant and other important components of the Project. The Esquimalt and Songhees support the goals of the Project and are participants in the Core Area wastewater system through service agreements. The Chiefs from each Nation are members of the Core Area Liquid Waste Management Committee. The Esquimalt and Songhees have leased land in the Victoria Harbour to the Project for use during construction. In recognition of their assistance in the planning and development of the wastewater system, and in recognition of their right to be consulted about the potential impacts of the Project on their Douglas Treaty rights, the CRD entered into support agreements with each of them. These agreements provide, amongst other things, for an Esquimalt Nation liaison

position and a Songhees Nation liaison position for the four year term of the Project. The liaison representatives have been assisting the CRD in its communications with the Esquimalt and Songhees communities, in the administration of protocols involving potential impacts on ancestral remains and their traditional lands, and in the discussion and management of other important Project-related issues.

There are four First Nations with communities near the Core Area, but outside the Core Area wastewater system. They are SȾÁUTW̱ (Tsawout), W̱SIḴEM (Tseycum), W̱JOŁEŁP (Tsartlip), and BOḰEĆEN (Pauquachin). These Nations are known as the W̱SÁNEĆ Nations, and the Residuals Treatment Facility and parts of the conveyance system are located on municipal roads or CRD lands within their traditional territories. The CRD and the W̱SÁNEĆ Leadership Council engaged in discussions about the construction and operation of Wastewater Treatment Project components in W̱SÁNEĆ Territory, and in December 2019 entered into a Memorandum of Understanding to provide capacity funding to allow this productive engagement to continue. In addition to providing capacity funding, the Memorandum of Understanding commits the CRD to move toward a negotiated agreement that considers the Project's presence within W̱SÁNEĆ territory, and engage in further discussions towards an agreement involving the broader relationship between CRD and the W̱SÁNEĆ Nations that takes into consideration CRD's operations within W̱SÁNEĆ territory and the recommendations of CRD's First Nations Task Force Final Report as adopted by the Board of the CRD.

There are ten other First Nations with Treaty rights in the general vicinity of the Core Area, which are primarily fishing rights in the Strait of Juan de Fuca. These Nations are the Scia'new (Beecher Bay), Stz'uminus, Halalt, Penelakut Tribe, T'Sou-ke, Lyackson, MÁLEXEŁ (Malahat), Lake Cowichan, Cowichan Tribes, and Nanoose First Nation (which is included because it is represented by a tribal association, the Te'mexw Treaty Association, which was formed by some of these Nations). The CRD concluded that the construction and operation of the Project, including the construction of outfall pipes, will not conflict with any of the Douglas Treaty rights of these Nations but, throughout the delivery of the Project, kept them informed of Project activities, especially as they relate to beneficial outcomes in the marine environment.

5.2.4.2 Communications and Engagement Plan

The key focus of the Project's communications and engagement activities were to keep residents and stakeholders informed of project plans, progress and construction information, and to receive and respond to questions and concerns raised by the community. Working in conjunction with CRD Corporate Communications, and utilising tools and developed relationships, the engagement and communications program included:

- Communications Planning, which involved developing plans and strategies in support of the Project;
- Community Relations, which involved building and maintaining positive relationships with Frist Nations, local governments, communities and other stakeholders, and keeping them informed through ongoing, two-way communications regarding the Project, and responding to inquiries in an effective and timely manner;
- Public Engagement, which involved gathering and receiving public input on certain aspects of the Project;
- Media Relations, which involved providing the media with progress reports and updates on the Project and responding to issues raised; and

- Construction Communications, which involved developing traffic management plans and a process to keep the public and stakeholders advised in a timely manner about matters relating to construction progress, schedules and impacts.

The Project Team prepared, implemented and annually updated a Project Communications and Engagement Plan. A variety of communications tools and engagement activities were utilized to support the implementation of the plan and ensure that information was easily accessible and distributed through a variety of methods. These included stakeholder meetings, Project website updates, social media posts, media updates for key Project milestones, construction notifications, door-to-door notifications, and a public inquiry program, among other methods.

The Project facilitated ongoing two-way community and stakeholder communications to ensure the public and stakeholders were well-informed; responded to inquiries; and ensured that Project managers were mindful of community interests and concerns. The communications and engagement team communicated with stakeholders, community groups, businesses and the public regarding Project schedules, progress, developments and construction information.

A liaison committee was set up for the Township of Esquimalt to provide a forum for the discussion of issues related to the construction and operation of the Wastewater Treatment Plant, the Macaulay Point Pump Station and Forcemain, and the Residual Solids Conveyance Line. The committee includes representatives from the Township of Esquimalt, West Bay Residents Association, Lyall Street Action Committee, Macaulay Elementary School Parent Advisory Committee, Department of National Defence, CRD, McLoughlin Point Wastewater Treatment Plant contractor Harbour Resource Partners, Macaulay Point Pump Station and Forcemain contractor Kenaidan Contracting Ltd. and Residual Solids Conveyance Line contractor Don Mann Excavating. This committee met monthly during construction and will continue to meet semiannually now that the McLoughlin Point Wastewater Treatment Plant is operating.

The Project Team met as necessary with three neighbourhood groups in Victoria that were in close proximity to Project Construction: the James Bay Neighbourhood Association, the Fairfield Gonzales Community Association, and the Victoria West Community Association. Engagement with these neighbourhood and community associations was focused on construction progress and disturbance mitigation measures.

The Project Team met with the Saanich Community Association Network (SCAN) and established a relationship with the Willis Point Community Association to provide updates on construction of the Residuals Treatment Facility at Hartland Landfill and the Residual Solids Conveyance Line.

In advance of commencing construction in a new area, community information open houses were a valuable communication tool to provide information about the different components of the Project to the public. Twenty open houses in Esquimalt, Victoria and Saanich were held for this purpose, as summarized in Table 6. Over 1,200 people attended these meetings, which were publicized widely through mailed notices to residents, email, newspaper advertisements, social media, and on the Project website.

Table 6 – Community Information Open Houses

Date	Community
January 11, 2017	Victoria - Fairfield Gonzales
January 11, 2017	Victoria - James Bay
January 12, 2017	Esquimalt
January 14, 2017	Esquimalt
January 18, 2017	Department of National Defence
April 5, 2017	Victoria - James Bay
April 12, 2017	Esquimalt
November 15, 2017	Saanich
November 18, 2017	Saanich
November 22, 2017	Esquimalt
November 27, 2017	Victoria
January 10, 2018	Victoria - James Bay (50%)
January 11, 2018	Victoria - Fairfield Gonzales (50%)
February 21, 2018	Niagara Street Information Meeting
February 24, 2018	Niagara Street Information Meeting
March 13, 2018	Esquimalt - Macaulay
September 25, 2018	Victoria – James Bay, Fairfield Gonzales
September 26, 2018	Victoria – James Bay, Fairfield Gonzales
November 27, 2018	Saanich
November 28, 2018	Saanich

Project updates were produced on a regular basis and at key Project milestones to provide information about the Project. This newsletter-style document highlights construction updates across various components of the Project. The updates were posted to the website, distributed to stakeholders, including MLAs, municipal Mayors and Councillors, and hand delivered to community centres.

In addition, 19 information sheets were developed to provide more details regarding the different Project elements. These information sheets were posted online, emailed to stakeholders and had hard copies distributed as appropriate.

To share specific and targeted information about upcoming construction impacts, 143 construction notices were developed. Each construction notice was hand delivered to residents near the work site, posted online and circulated to stakeholders via email as appropriate. Approximately 9,800 construction notices were hand delivered for this Project.

The Project communications and engagement team worked with the CRD's Senior Manager of Corporate Communications to brief journalists to ensure that local, regional, provincial, national and international media were informed about key Project milestones, and to provide information for timely media responses. The Deputy Project Director was the Project's spokesperson, and regularly spoke to media to provide Project updates.

An inquiry response program was established to track, record and provide accurate and timely responses to questions or concerns from the public and stakeholders. It comprised an email address (wastewater@crd.bc.ca) and a 24/7 Project information telephone line 1-844-815-6132. Since September 2016, the Project Team responded to 2,127 inquiries, as summarised in Table 7.

Table 7 – Project Inquiries

Inquiry Source	Contacts (September 2016 - May 2021)
Information phone line inquiries	1,221
Email inquiries responded to	906
Total inquiries responded to	**2,127**

5.2.5 Schedule

The Project's schedule key performance indicator was to deliver the Project by December 31, 2020. The Project completed the majority of construction by that date, and achieved its schedule-related goal, which was to meet or exceed federal regulations for secondary treatment of wastewater by December 31, 2020.

All aspects of the Project that were required to meet the regulatory requirements were delivered by December 31, 2020: in the third quarter of 2020, the Clover Point and Macaulay Point Pump Stations diverted the Core Area's wastewater, through the Clover and Macaulay Forcemains, respectively, to the McLoughlin Point Wastewater Treatment Plant, for tertiary treatment; and from the third quarter of 2020, the Residuals Solids Conveyance Line conveyed residual solids to the Residuals Treatment Facility.

The Residuals Treatment Facility commenced production of class A biosolids later than anticipated, in January 2021, and commissioning of the facility is ongoing and is anticipated to be complete in June 2021.

On the conveyance component of the Project, the Arbutus Attenuation Tank and Clover Point Pump Station are the only Project sites with some minor construction activities remaining. The Arbutus Attenuation Tank is being built to increase the capacity of the conveyance system and is expected to be operational in June 2021, and the remaining work on the Clover Point Pump Station is expected to be complete in fall 2021: it has been delayed by the need to remove debris from the inlet channel that has built-up over decades of use.

Figure 17 shows a comparison of the achieved Project schedule against that forecast in the Project Charter – which was a high-level schedule that was developed to be optimised and refined as the Project and planning progressed.

It was noted in the Project Charter that, in order to meet the federal regulations for treatment of the Core Area's wastewater by December 31, 2020, the Project schedule was ambitious. It was further noted that while the Project schedule was achievable there was no float.

Therefore, despite the Project schedule not including an allowance for a global heath pandemic (that impacted workforce availability, workforce productivity and equipment and material deliveries), the Project met the goal of meeting or exceeding federal regulations for secondary

treatment of wastewater by December 31, 2020, and completed the majority of construction by December 31, 2020.

As of May 2021, the vast majority of construction has been completed (the Arbutus Attenuation Tank and Clover Point Pump Station are the only Project sites with some minor construction activities remaining). The works remaining under each construction contract are summarised in section 7 of this report, and the Project budget includes committed funds to complete the remaining works and close-out the construction contracts.

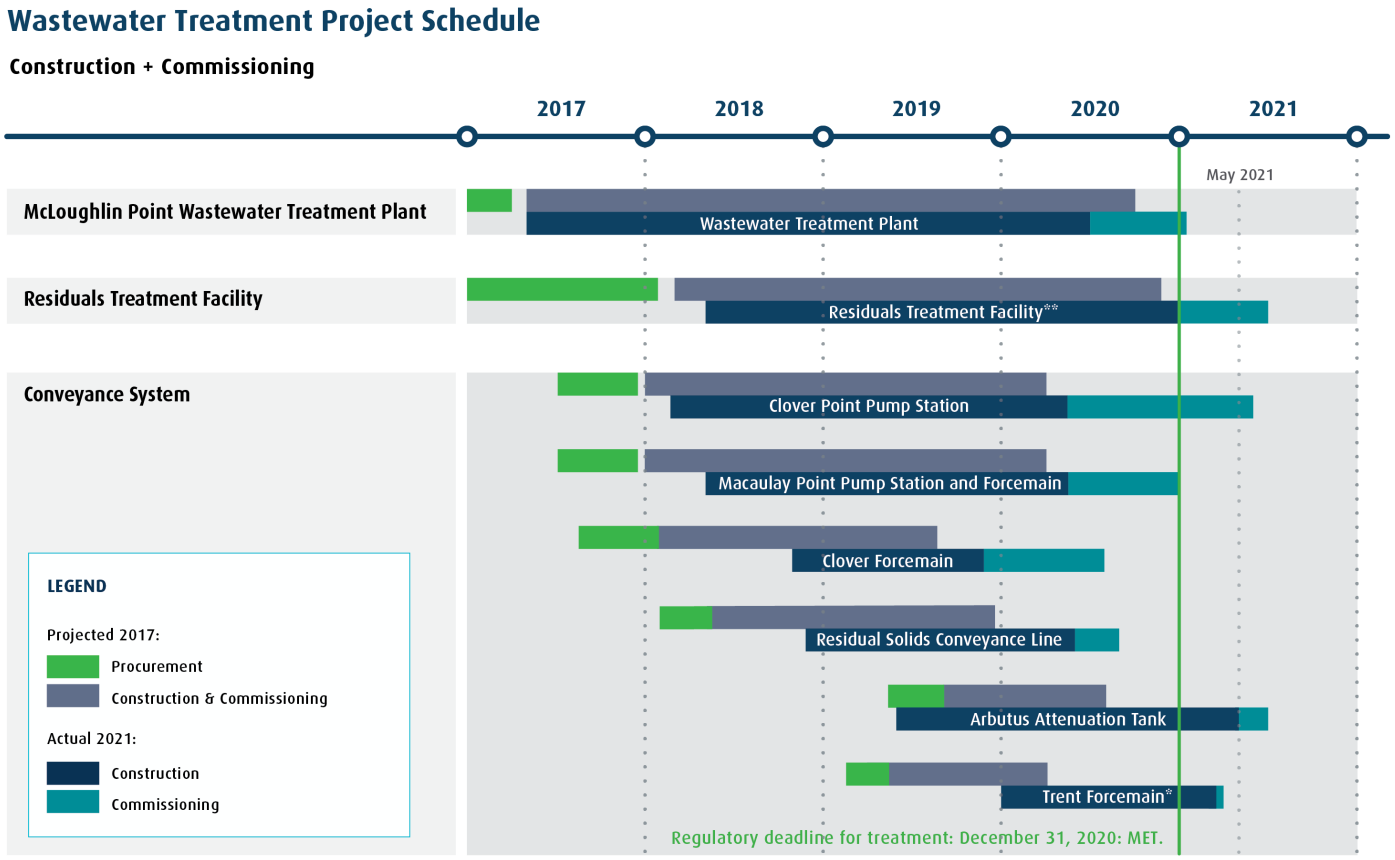

Figure 17 - Schedule comparison: March 2017 forecast to May 2021 actual

Notes to Figure 17:

** In 2019, the Wastewater Treatment Project's scope was refined to remove three components of the conveyance system (expanding the capacity of the Currie Pump Station, twinning the Currie Forcemain and twinning the East Coast Interceptor), as they would provide no benefit to the CRD's residents and businesses.*

*** The Residuals Treatment Facility commenced production of class A biosolids later than anticipated, in January 2021, and commissioning of the facility is ongoing and is anticipated to be complete in June 2021.*

**** The commissioning time period shown is the timeline for each Project contractor to complete their commissioning requirements. Upon each Project contractor completing their commissioning requirements, the responsibility for operating the component is transferred from the relevant Project contractor to the CRD's Integrated Water Services department, who are then responsible for managing the optimisation of the operation of each Project component and any resultant impacts on the operation of the other components of the core area wastewater system.*

5.2.6 Cost

The Business Case established the Control Budget of $765 million. The Project's cost key performance indicator was to deliver the Project within the Control Budget ($765 million). In May 2019 the CRD Board approved an increase in the Project's budget by $10M to $775M.

While the total Project cost will not be known until total completion of all contracts, which is anticipated to occur in Q4 2021, it is forecast that the total Project cost will be approximately $766.7M, which is within the approved budget of $775M. The total Project cost is therefore forecast to exceed the Project's Control Budget (of $765M) by 0.2%, but be well within the budget subsequently-approved by the CRD Board (of $775M).

The total Project cost forecast of $766.7M includes:

- costs expended to-date to plan, procure, construct and commission the Project;
- the forecast cost to complete the activities remaining to close-out the construction contracts and the obligations remaining to be fulfilled in the Project's funding, First Nation and land access agreements; and
- an appropriate amount of contingency ($2.74M), based on the Project Team's assessment of the: status of each component; the risks associated with the remaining work and the outstanding obligations; and the funds and resources committed to complete these.

The total Project cost forecast includes all Project costs, being those incurred in order to plan, procure, construct and commission the Project components. The Project budget does not include the costs to operate and maintain the Project components, which are included in CRD operating budgets. Operating and maintaining costs include (but are not limited to) the costs of: optimising the operation of the Project components after handover from the relevant Project contractor to the CRD's Integrated Water Services department; the cost of the transportation and use of biosolids produced by the Residuals Treatment Facility; the amount by which the operating period payments for the Residuals Treatment Facility exceed the net present value of the capital cost; and the cost of CRD's management of any required warranty work (the Project budget covers the cost of each Project component's warranty, but not the cost of CRD's oversight of warranty work).

Several factors resulted in the Project not meeting its cost KPI. The Project Team reported budget pressures through its monthly reports to the Project Board (and CRD Board) since September 2017, primarily as a result of inflation in the Vancouver Island construction market. Other factors that contributed to budget pressures include: design development to incorporate stakeholder input; geotechnical considerations including removal and disposal of a significant quantity of contaminated material; and schedule constraints associated with the requirement to provide wastewater treatment by the regulatory deadline of December 31, 2020.

In addition, since the onset of the global health pandemic, the Project Team reported cost impacts from the COVID-19 public health emergency. Impacts included labour availability and productivity (as a result of work modifications required to comply with provincial guidelines), and delays to the delivery of equipment and supplies.

Countering these budget pressures, Project risks were diligently and proactively managed, and there were significant cost savings in the Project's forecast financing costs. As outlined in

section 6.4, these resulted from the CRD's financing strategy, combined with low interest rates and early payment of a significant proportion of the Province's funding.

Attached as Appendix B to this report is a cost report for the Project, showing a detailed breakdown of the budget at April 30, 2021, including costs expended and the forecast funds and contingency required to complete the Project-related commitments and activities that extend beyond May 2021 (see section 7 of this report for further information on those commitments and activities).

5.2.6.1 Project Cost Comparison

Table 8 shows a comparison of total forecast cost compared to the allocated Control Budget approved by the Project Board on June 6, 2017, and Table 9 provides the main reasons for the differences. The allocated Control Budget was used as the basis for the Project Team's management of the budget and reporting, including to control costs, commitments, use of contingency and manage cash flow.

One component of the allocated Control Budget is the Project Management Office (PMO) budget, which was approved by the Project Board on January 10, 2017. At that time, KPMG carried out an exercise to review and benchmark the PMO budget against industry standards. KPMG found that industry standards were that the PMO budget of a project should make up between 5 and 13% of the total project cost, exclusive of engineering costs. KPMG considered the complexity of the Wastewater Treatment Project, and noted that the Project entailed: complex procurements with a number of different contract types (DBB, DBF and DBFOM); integration and commissioning of multiple components; and a significant number of internal and external stakeholders. Based on this assessment of complexity, and the fact that the Project's PMO budget, inclusive of engineering costs, was 10% of the total project cost, KPMG determined that the PMO Budget was well within industry standards.

Table 8 – Comparison of Total Forecast Cost against the Allocated Control Budget (all in $ millions)

Project Component	Control Budget Approved June 6, 2017	Total Forecast Cost[1]	Variance
McLoughlin Point Wastewater Treatment Plant	$331.4	$336.3	($4.9)
Residuals Treatment Facility	$159.4	$140.2	$19.2
Conveyance System	$158.2	$206.5	($48.3)
Project Management Office	$75.8	$72.5	$3.3
BC Hydro	$12.9	$2.7	$10.2
Third Party Commitments	$8.1	$8.5	($0.4)
Sub-Total	**$745.9**	**$766.7[2]**	**($20.8)**
Program Reserve	$19.2	$8.3	$10.9
Total	**$765.0**	**$775.0**	**($10.0)**

Notes to Table 8:

1. *Total forecast cost is the forecast cost at completion, and comprises:*

a. *$617.2M of costs expended at April 30, 2021, which includes invoices received and processed before the cut-off for the April 2021 cost period;*

b. *$157.8M of funds to cover:*

   i. *work completed but not yet invoiced (i.e. invoices for work already completed but not yet invoiced by the cut-off for the April 2021 cost period); and*

   ii. *the work required to complete the Project-related commitments and activities that extend beyond May 2021 (see section 7 of this report for further information on those commitments and activities); and*

c. *$2.74M of contingency to manage the risks associated with completing the Project-related commitments and activities that extend beyond May 2021, comprising:*

   i. *$1M to cover the potential performance incentive payment to HRP, that is payable after the completion of the performance period (which concludes on January 12, 2023), and will be payable at an amount (of up to $1 million) to be determined based on performance against milestones over the two year performance period; and*

   ii. *$1.74M for the conveyance component, which is anticipated to be more than sufficient given the nature of the remaining commitments and activities (see section 7 of this report for further information on those commitments and activities).*

2. *While the total Project cost will not be known until total completion of all contracts, which is anticipated to occur in Q4 2021, it is forecast that the total Project cost will be approximately $766.7 M, which is within the approved budget of $775M.*

3. *A program reserve of $19.2 million was included in the Control Budget to manage risks impacting the entirety of the Project, or the interface between any of the Project components.*

   At April 30, 2021, $8.3 million remains in program reserve; this is in addition to $2.74M of contingency that is included within the total forecast cost of $766.7M, as outlined in note 1 to manage the risks associated with completing the Project-related commitments and activities that extend beyond May 2021.

Table 9 summarises the main reasons for the differences between the total forecast cost compared to the allocated Control Budget approved by the Project Board on June 6, 2017

Table 9 – Principal Factors causing Variances between the Total Forecast Cost and the Allocated Control Budget

Project Component	Variance ($ millions)	Principal Factors Driving Variance
McLoughlin Point Wastewater Treatment Plant	($4.9)	- Significantly greater contamination at site than forecast: see section 5.2.2 for further information - Cost impacts from the COVID-19 public health emergency: impacts included labour availability and productivity (as a result of work modifications required to comply with provincial guidelines). + Lower than forecast financing costs: see section 6.4 for further information
Residuals Treatment Facility	$19.2	+ Strong market response to procurement (opportunity big enough to attract qualified contractors from across North America) + Rescoping of storage area: see section 4.2.1 for further information
Conveyance System	($48.3)	- Inflation in the Vancouver Island construction market - Design development to incorporate stakeholder input + Value engineering combined with substantial reduction in water use per person reduced required scope: see section 4.3.7.1 - Cost impacts from the COVID-19 public health emergency: impacts included labour availability and productivity (as a result of work modifications required to comply with provincial guidelines). + Lower than forecast financing costs: see section 6.4 for further information
Project Management Office	$3.3	+ Efficient delivery
BC Hydro	$10.2	+ Efficient delivery
Third Party Commitments	($0.4)	- Commitments slightly greater than estimated
Program Reserve	$10.9	A program reserve of $19.2 million was included in the Control Budget to manage risks impacting the entirety of the Project, or the interface between any of the Project components. At April 30, 2021, $7.8 million remains in program reserve.
Total	$-	

6 Project Successes and Challenges

The most significant Project challenges, and actions that contributed to the successful management of them, are summarised in the following sections.

6.1 Safety

Maintaining safety as the Project's top priority was critical given the scope, scale and complexity of construction, and its performance in an urban environment during a period of time that included a global health pandemic.

Key to meeting this challenge was:

- All of the Project's Prime Contractor's continued commitment to safety as the number one priority on the Project;
- All of the Project's Prime Contractor's implementation of additional precautions during the global health pandemic to comply with provincial guidelines and protect their workers, CRD staff and the public;
- The Project Team's maintenance of a strong safety-first culture – beginning with the evaluation of contractors' safety performance, personnel and practices as part of all construction procurements, and progressing through chartering sessions to ensure new Project contractors understood the primary importance of safety, and a robust oversight and audit program that included regular site inspections, reviewing safety incidents with prime contractors to discuss lessons learned and how corrective actions are being implemented as a result of these reviews, and the sharing of trending observations or similar incidents between Project contractors;
- Comprehensive monthly reporting of safety incidents, including descriptions of the incident, the outcome and corrective actions – for all categories of safety incidents from near misses to recordable incidents; and
- Acknowledgement that safety is everyone's responsibility.

6.2 Schedule: Project Delivery to meet the Regulatory Deadline

As noted in the Project Charter, in order to meet the federal regulations for treatment of the Core Area's wastewater by December 31, 2020, the Project schedule was ambitious. To plan, procure, construct and commission the Project within five years - from the time the Project Board was appointed to the regulatory deadline for treatment – required:

- the co-operation of multiple parties and governance bodies; and
- procuring and constructing some components through multiple contracts in order to optimise the design, procurement, construction and commissioning schedule, which necessitated the Project Team expending a greater effort on contractor and interface management.

Key to meeting this challenge was:

- The CRD Board's delegation of authority to the Project Board, as this allowed for appropriate oversight and governance by a body with expertise in major project management and construction that could focus solely on delivery of the Project in order to achieve the goals established for it;

- The inclusion of the CRD's Chief Administrative Officer on the Project Board, as this facilitated CRD integration and support, and the identification and implementation of CRD policies and procedures relevant to the Project's delivery;
- The establishment of a Project Team with the relevant expertise required to deliver the Project;
- The full support of the CRD, and the integration of CRD departments in Project delivery, as this provided institutional knowledge and expertise that was critical to allowing the immediate commencement of, and expeditious progress to be made in, Project planning and delivery;
- The input and engagement of the Project's First Nations partners;
- The collaboration and cooperation of host municipalities, funding partners and regulatory authorities;
- Schedule mitigation by the Project's contractors;
- The engagement of community and neighbourhood associations which assisted in the identification of concerns and interest allowing the Project to respond or adjust plans as appropriate;
- The willingness of transit and other service providers to coordinate with our contractors to work around impacted areas while continuing to provide service to the community; and
- The patience of the CRD's residents, commuters, businesses and stakeholders, particularly those most impacted by the Project's construction and operations.

Also of significance in meeting the challenge was the Project Team's approach to schedule management, which included the following steps:

- the establishment of the master project schedule, which was the primary planning and coordination tool for schedule management;
- the development and maintenance of a permit register to identify and monitor the status of permits, approvals, authorizations, licences and agreements that may be required for the Project.
- the inclusion of relevant milestones, schedule incentives and acceleration clauses in each construction contract;
- the maintenance of the master project schedule through the review and incorporation of contractors' baseline and monthly updated schedules; and
- monitoring progress and taking action as required to manage the interfaces between the different Project contracts and meet the Project's key performance indicators.

6.3 Delivering a Major Infrastructure Project in an Urban Setting

The delivery of a major infrastructure project in an urban setting with construction in three different municipalities presented multiple challenges, including: design and construction complexity as a result of congested utility corridors and substantial road use; how to manage stakeholder impacts and build infrastructure to meet different municipal requirements.

The Project met these challenges through the establishment of individual technical working groups with all three host municipalities: this allowed for the collaboration and cooperation of host municipalities as components were designed, procured and constructed.

Section 5.2.4 outlines the significant efforts made to build and maintain positive relationships with First Nations, local governments, communities, and other stakeholders, and these undoubtedly contributed to addressing the challenges of building such significant infrastructure in an urban environment. A particular example of how the challenges were met is provided by the management of stakeholder impacts during the staging of the cross-harbour pipe.

For six weeks, Niagara Street, a small, residential street, was used to assemble a 940-metre pipe above ground before it was pulled into a cross-harbour undersea tunnel from Ogden Point to McLoughlin Point.

Beginning the first week of March 2018, 78 pipe sections were welded together and the pipe was moved into place on rollers on Niagara Street across eight city blocks from South Turner Street to St. Lawrence Street. Over three days, cranes and sidebooms lifted the pipe in the 100 block of Niagara Street where the pipe was threaded into the tunnel at Ogden Point and pulled from the McLoughlin Point side.

Managing the significant impacts that this work had on the neighbourhood involved comprehensive planning to coordinate with the contractor, local authorities and service providers; and extensive communications and engagement with local residents. Some of the community outreach included:

- A door-to-door survey which was conducted with Niagara Street residents to provide updated information and a resident needs assessment in December 2017;
- Two community meetings with residents to answer questions which were held on February 21 and February 24, 2018;
- A Help Tent that was located in the 200 block of Niagara Street and staffed by a Project representative to provide information and answer questions about the Project;
- The 24/7 phone line and project email address were provided to residents so that they could request information or report a concern; and
- A community BBQ was held on May 1, 2018 as a thank you to the residents for their patience.

As a result of the community outreach undertaken, and the patience and understanding of the community, the Project Team and Project contractor (Harbour Resource Partners) built positive relationships within the community, many of whom expressed an interest in witnessing a remarkable engineering feat.

6.4 Cost

The Project faced significant cost pressures as a result of several factors including inflation, greater than anticipated contamination, and the global health pandemic, as outlined in Section 5.2.6 of this report.

Key to meeting this challenge was:

- The ability to manage risk: risk management on the Project involved the identification, analysis, oversight, treatment and monitoring of the Project risks. The Project Leadership Team promoted a risk-aware culture whereby any person was encouraged to raise potential risks for consideration. The success of this approach was supported by the findings of Ernst and Young when they conducted an

independent project execution review part-way through Project delivery (in April 2019), and reported:

  - A strong risk-aware culture that was supported by well-defined processes and risk registers;
  - The Project Team had put careful consideration into risk transfer when structuring contracts. Notable and leading industry practices around controlling mechanisms are in place, including incentive and penalty clauses; and
  - Project reporting to be comprehensive and forward-looking, with commentary to provide the necessary context around key items.

- Lower than forecast financing costs: due to the Project's funding sources and related conditions, there were differences in timing between incurring and recovering Project-related costs. As a result of these differences, the CRD's Finance Department needed to develop and implement a financing strategy to manage cashflow to meet the Project's financial commitments. The financing strategy implemented, combined with low interest rates and early payment of a significant proportion of the Province's funding resulted in significant cost savings in the Project's forecast financing costs, which helped to offset the budget pressures described in section 5.2.6 of this report.

6.5 Interfaces between Project Components

Managing the physical and schedule interfaces between the different components required to deliver the overall Wastewater Treatment Project was a challenge.

Key to meeting this challenge was:

- The inclusion of elements with critical interfaces into a single contract – where the resulting risk profile, type of work and size of the package, would still allow for sufficient market interest in the package such that competitive pricing would be received - for example:
  - the Macaulay Point Pump Station and Forcemain were procured together in a single contract; and
  - three elements (the McLoughlin Point Wastewater Treatment Plant, marine outfall and harbour crossing) were included in a contract to allow a single contractor to manage the physical and schedule interfaces between these components with critical interfaces
- The use of a single owner's engineer to develop the indicative design for all critical Project components with significant interfaces;
- The use of a single systems integrator to develop standards and implement an approach for computerised controls and communication; and
- Developing of a master project schedule that allowed for a logical sequence of commissioning activities, considering that construction of the Project would be achieved through multiple contracts and that each required the delivery of waste streams to achieve completion.

6.6 Construction Challenges

Construction challenges included: geotechnical considerations (especially protecting the integrity of the Dallas Road bluffs during the construction of the Clover Forcemain component of the Project); working in proximity to water; managing contaminated soils and utility conflicts; constructing on constrained sites (especially at McLoughlin Point); and building in areas with archaeological sites and the potential for archaeological finds.

Key to meeting these challenges were:

- Hiring experienced design consultants and construction contractors;
- Developing plans and procedures, both Project-wide and component-specific that mitigated potential adverse environmental impacts;
- Technical peer review of alternative solutions to complex challenges;
- Specific to the site constraints: developing indicative designs sufficiently during procurement processes to ensure designs were selected that were technically-feasible and could be constructed within the site constraints;
- Colloborating with First Nation partners; and
- Hiring archaeological advisors to provide advice and assistance with respect to archaeological management, including by:
    - preparing Archaeological Overview Assessments and Archaeological Impact Assessments;
    - planning for archaeological mitigation and data recovery;
    - preparing archaeological protocols and specifications for inclusion in construction contracts;
    - conducting archaeological awareness training for construction crews; and
    - undertaking archaeological monitoring with the support of First Nation partners.

6.7 Integration of the Project Components into the Existing Core Area Wastewater System

The integration of new Project components into an existing operating system presented several challenges.

These challenges were managed through the:

- Engagement of representatives from CRD's Integrated Water Services department in the review of design and construction submittals;
- Commitment and support of CRD operating staff , especially through the commissioning period;
- Inclusion in the construction contracts of requirements regarding the training that contractors had to provide to CRD operating staff;
- Project funding of the following initiatives as the CRD planned to integrate the Project components into the core area system:
    - Operational Readiness Review: a performance-based examination of facilities, equipment, personnel, procedures and management control systems for ensuring the Project assets can be operated safely and securely

in compliance with the applicable legislative and regulatory frameworks and in accordance with the policies and delegated responsibilities of the CRD.

- SCADA IT Network Design – Phase 1: starting with the existing network topologies and IP addresses, this study provided a high level design that accounted for the future mapping that would be required for the most intense deployment, in order to provide input on the Project sites now that considers the future goal of the CRD IT/SCADA Network, thereby reducing the need for modifications in the future.
- Asset Management Study: a study to develop a master list of assets with associated attributes that will be stored in Asset Accounting to meet financial processes and long-term capital planning needs for all the infrastructure related to the Core Area Wastewater Treatment Project and Service.

6.8 Establishment of Project Office

The establishment of a Project Team with the relevant expertise required to deliver the Project was key to meeting all of the Project goals, but it presented a potentially-significant challenge to find individuals with appropriate Project delivery experience that were both available and interested in committing to a Project in Victoria for a relatively short-term position.

The Project managed this challenge by recruiting key Project team members, and supplementing them with consultant support as required. For financial, engineering and administrative resources, the Project was aided in meeting this challenge by the ability to second some resources from the CRD, and also the potential for Project resources to apply for and transition to employment opportunities at the CRD.

The Project Board and Director were successful in attracting and retaining the core competencies required throughout delivery of the Project, and this strategy allowed for continuity through dedicated Project team members, while also providing a means to manage the natural variation in resource needs as the Project progressed, and gain access to specialist skill sets as required.

7 Project Handover

The Project Board have fulfilled their role and function as defined in the Terms of Reference, and the term of the Project Board concludes on May 24, 2021. This report section outlines the Project-related commitments and activities that extend beyond May 2021, and is organised in three categories:

i) Activities related to closing-out the Project's construction contracts;
ii) Obligations remaining to be fulfilled in the Project's funding, First Nation and land access agreements; and
iii) Operating and maintenance obligations related to the infrastructure built by the Project.

This report section outlines Project-related commitments and activities that extend beyond May 2021 and that are transitioning from the Project to the CRD. In addition there are organizational/corporate leadership, administrative and support function responsibilities that the CRD will need to fulfill as a result of the addition of the Project components to the core area wastewater system.

7.1 Close-out of the Project's Construction Contracts

As of May 2021, the vast majority of construction has been completed (the Arbutus Attenuation Tank and Clover Point Pump Station are the only Project sites with some minor construction activities remaining). The works remaining under each construction contract are summarised in Table 10, and the Project budget includes committed funds to complete the remaining works and close-out the construction contracts.

Table 10 – Summary of Works Remaining on the Project's Construction Contracts at May 2021

Project Component	Contract Type	Summary of Works Remaining at May 2021
McLoughlin Point Wastewater Treatment Plant	DBF	Providing advice and guidance to optimize plant performance over the remainder of the two-year performance period (to January 12, 2023) and complete warm weather odour test.
Residuals Treatment Facility	DBFOM	Complete activities required to achieve Completion; minor deficiency items and record drawing submission.
Macaulay Point Pump Station and Forcemain	DB	Landscaping, minor deficiency items and record drawing submission
Clover Point Pump Station	DB	Generator ventilation rectification; inlet channel debris removal; final acceptance testing; minor deficiency items and record drawing submission
Clover Forcemain	DBB	Quarterly post-construction stability surveys over the warranty period
Residual Solids Pump Stations	DBB	Removal of low floats and upgrade programming; landscaping, minor deficiency items and record drawing submission
Trent Forcemain	DBB	Restoration, minor deficiency items and record drawing submission
Arbutus Attenuation Tank	DBB	Final commissioning activities, site grading and landscaping, minor deficiency items and record drawing submission

The Project budget also includes committed funds for the resources required to oversee the completion of the remaining works and close-out the construction contracts. Specifically, the

Project budget includes committed funds for the following resources to support close-out post May 2021:

- Project staff transitioning to the CRD, including project management, document control and finance staff resources that the Project budget will fund post May 2021;
- Project consultants: funds have been committed for design consultants (KWL and Parsons) and the Project's owner's engineer (Stantec), to support Project close-out activities; and
- The remainder of the CRD finance department allocation for 2021.

7.2 Obligations Remaining to be Fulfilled in the Project's Funding, First Nation and Land Access Agreements

In addition to the Project's nine construction contracts, approximately 20 funding, First Nation and land access agreements were entered into in order to deliver the Project (refer to Appendix C for a list of the agreements). There are a relatively small number of obligations remaining to be fulfilled in the Project's funding, First Nation and land access agreements. The Project budget includes committed funds to fulfil the outstanding obligations, and the Governance Transition Report details both the fulfilled and the outstanding commitments.

7.3 Operation and Maintenance of Infrastructure Built by the Project

7.3.1 Responsibility for Operations and Maintenance of Project Components

The CRD's Integrated Water Services department are responsible for operating and maintaining all of the Project components other than the Residuals Treatment Facility (see section 7.3.3) upon the relevant Project contractor completing their commissioning requirements. This transfer has occurred for all components other than the Arbutus Attenuation Tank, for which the transfer is forecast to occur in June 2021.

This responsibility includes:

- managing the optimisation of the operation and maintenance of each Project component upon handover, and any resultant impacts on the operation of the other components of the core area wastewater system;
- managing the contractual warranties for each of the Project components;
- administering the two-year performance period for the McLoughlin Point Wastewater Treatment Plant, as outlined below.

The McLoughlin Point Wastewater Treatment Plant contract includes a two-year performance period, from the acceptance date (January 2021). Over the performance period the CRD will operate and maintain the McLoughlin Point Wastewater Treatment Plant, and Harbour Resource Partners are responsible for:

- monitoring operations;
- consulting with and providing advice to the CRD and the CRD's plant manager with respect to the operation of the Facility;
- assisting with environmental and regulatory compliance;
- preparing and updating the operations manual and operations and maintenance plans;
- assisting with the evaluation of the performance of the Project and the implementation of plans to achieve continued compliance with the process performance guarantees;

- assisting with the development and implementation of plans that will minimize use of power, chemicals, water and labour; and
- responding to warranty claims.

There are physically interfacing works and screened, degritted wastewater is required to be delivered in order for the performance period to operate as intended. Responsibility for these interfaces is retained by the CRD: it was the Project Team's responsibility to manage the interfaces during construction and commissioning, and upon the acceptance date (January 2021), the CRD's Integrated Water Services department assumed responsibility for the operation of the McLoughlin Point Wastewater Treatment Plant and the management of the interfaces.

As noted earlier in this report, the Project met it's regulatory requirements key performance indicator (to deliver the Project such that the Core Area complies with provincial and federal wastewater regulations). Specifically, the McLoughlin Point Wastewater Treatment Plant operated in compliance with the provincial and federal wastewater regulations over the three month period from the start of November 2020 to the end of January, 2021, and since April 18, 2021. In the interim period (between the start of February and mid-April, 2021), a number of operating challenges arose, resulting in the discharged effluent exceeding the permitted quality limits. The Plant has continuously treated wastewater since being commissioned, but over the interim period, the discharged effluent was closer in quality to that which would be produced from a secondary treatment plant than a tertiary.

Operating and equipment challenges of the nature experienced at the McLoughlin Point Wastewater Treatment Plant are not uncommon in the period of time immediately after handover of an operating facility from a contractor to an operator, as a period of fine-tuning and optimising operations is to be expected. The Plant is now in compliance with the regulations, and treating wastewater to a tertiary level.

7.3.1.1 Operational Readiness Review

The Project funded the engagement of independent experts to conduct an Operational Readiness Review. This review commenced prior to the transition of Project components from the commissioning phase to the operating phase, with the objective of seeking an independent review of the transition planning conducted and ensure:

- equipment, facilities, and systems were in a state of readiness to safely and securely conduct operations in accordance with the operating plans and performance objectives;
- management control programs were in place to ensure safe and secure operations could be sustained; and
- user/operating organization personnel were trained and qualified.

7.3.2 Contract Administration of Residuals Treatment Facility Project Agreement

The Residuals Treatment Facility was procured through a design-build-finance-operate-maintain contract under which Hartland Resource Management Group have the responsibility to design, build, partially-finance, operate and maintain the facility to meet the performance specification and contract requirements over the term of the contract.

The Residuals Treatment Facility has been constructed and is close to completing commissioning, and the Hartland Resource Management Group will be responsible for operating and maintaining the facility over the next 20 years. The Project's committed budget includes the net present value of the capital cost of the Residuals Treatment Facility: the CRD's operating budget will need to fund the amount by which the operating period payments for the Residuals Treatment Facility exceed the net present value of the capital cost.

There are physically-interfacing works and residual solids required to be delivered and biosolids required to be transported in order for the contract to operate as intended. The CRD's Parks and Environmental Services Department are responsible for managing these interfaces and administering the contract over the 20 year operating and maintenance period.

7.3.3 Permits

The CRD's Parks and Environmental Services Department and/or Integrated Water Services department (as applicable) are responsible for environmental monitoring and/or mitigation activities related to the operation and maintenance of Project components, and maintaining and complying with the terms of operating permits and the limited number of construction-related permits that have obligations that extend beyond the commissioning period.

7.3.4 Responsibility for Operations and Maintenance of Project Amenities

In furtherance of the Project's goal to deliver a solution that adds value to the surrounding community and enhances the liveability of neighbourhoods, the Project either funded or funded and delivered a number of amenities and/or infrastructure improvements (as outlined in Section 5.1.4). These amenities and infrastructure improvements have been transferred to the benefitting municipality to operate and maintain.

7.4 Knowledge Transfer

Project knowledge transfer has been achieved through:

- The support and integration of the CRD throughout the planning, design, procurement and construction of the Project – including through the secondment of CRD resources, and CRD resource review of Project submittals;
- The continuity of personnel through the transfer of resources from the Project Team to CRD positions; and
- The retention of Project records.

Appendix A – Guiding and Key Supporting Documents

CRD Core Area Wastewater Treatment Project Board Bylaw No. 1, 2016

The CRD Core Area Wastewater Treatment Board Bylaw No. 1, 2016 established the Project Board for the purposes of administering the Project. Attached to the bylaw are the Project Board's Terms of Reference, which set out the role, responsibilities and function of the Project Board. The Terms of Reference also provide a framework that includes the Project vision and goals, guiding principles and values, Project Board meeting protocols, confidentiality considerations and identifies those matters that must be referred to the CRD Board for approval. The bylaw was adopted by the CRD Board on May 25, 2016.

Business Case

The Business Case defined the scope of the Project and established the control budget of $765 million (the "Control Budget"). The CRD Board approved the Business Case on September 14, 2016.

Core Area Liquid Waste Management Plan

The Core Area Liquid Waste Management Plan ("CALWMP") outlines CRD's wastewater management strategies, including wastewater treatment under the Environmental Management Act.

Amendment 11 of the Core Area Liquid Waste Management Plan defines how the CRD will treat wastewater in the Core Area. The CRD has received approval from the Ministry of Environment for Amendment 11 on the condition that a definitive plan for the beneficial use of biosolids be submitted to the Minister by June 30, 2019

The CALWMP also includes seven liquid waste management initiatives designed to protect the core area's water quality: monitoring and sampling; harbour stewardship; watershed protection; trucked liquid waste management; inflow and infiltration; onsite septic maintenance; and source control.

Project Charter

The Project Charter was developed to define the parameters and establish the mandate for the Project Team to execute and deliver the Project. The Project Charter included the Project goals from the Project Board's Terms of Reference and established key performance indicators for the Project. The Project Charter also includes a description of roles and responsibilities, and presents a high-level description of the Project budget, schedule, scope, risks, and stakeholders. The Project Charter was first approved by the Project Board on April 4, 2017, and was subsequently updated twice to account for progress made on delivering the Project, with each update approved by the Project Board (on April 27, 2018 and September 30, 2019).

Project Management Plan

The Project Management Plan specified the project management objectives and approaches intended to be used to achieve the key performance indicators (as established in the Project Charter); and stated the key organizational roles and responsibilities anticipated to be required

to provide effective management, administration and control of the Project. The Project Management Plan was approved by the Project Board on September 26, 2018.

Risk Management Plan

The Project's Risk Management Plan included the risk management process, roles and responsibilities, management escalation hierarchy and requirements for risk meetings and reporting cycles, in order to direct and empower the Project Team to: develop and maintain a 'risk aware' culture; provide a comprehensive risk identification and control process; and to proactively forecast and report on risks. The Project Risk Management Plan was approved by the Project Board on March 29, 2018.

Communications and Engagement Plan

The Project's Communications and Engagement Plan defined the Project's communications and engagement goals, described the communications and engagement activities during the construction period; and described the roles and responsibilities of the Wastewater Treatment Project's Communications and Engagement Team, which included CRD staff, consultants and representatives from the contractors for each component of the Project. The Project's Communications and Engagement Plan was first approved by the Project Board on April 4, 2017, and was subsequently updated twice to account for progress made on delivering the Project, with each update approved by the Project Board (on July 26, 2018 and July 25, 2019).

Appendix B – Project Cost Report at April 30, 2021

Appendix B: Project Cost Report at April 30, 2021

Description	BUDGET		COST EXPENDED		FORECAST	
	Control Budget	Allocated Budget	Expended to April 30, 2021	Expended to April 30, 2021 as a % of Allocated Budget	Forecast to Complete	Forecast at Completion
McLoughlin Point Wastewater Treatment Plant	**331.4**	**336.3**	**329.5**	**98%**	**6.8**	**336.3**
Construction	306.7	334.4	329.3	98%	5.1	334.4
Contingency	14.9	1.0	-	0%	1.0	1.0
Financing	9.8	0.9	0.2	26%	0.7	0.9
Residuals Treatment Facility	**159.4**	**140.2**	**12.7**	**9%**	**127.5**	**140.2**
Construction	145.4	139.8	12.7	9%	127.1	139.8
Contingency	12.3	-	-	0%	-	-
Financing	1.7	0.4	-	0%	0.4	0.4
Conveyance System	**158.0**	**206.5**	**198.9**	**96%**	**7.6**	**206.5**
Macaulay Point Pump Station	25.4	32.4	32.1	99%	0.3	32.4
Macaulay Forcemain	5.6	7.4	7.4	100%	-	7.4
Craigflower Pump Station	12.5	12.4	12.4	100%	-	12.4
Clover Point Pump Station	23.7	28.7	27.4	96%	1.3	28.7
Currie Pump Station^	2.8	0.1	0.1	100%	-	0.1
Arbutus Attenuation Tank	14.2	24.6	22.9	93%	1.7	24.6
Clover Forcemain	14.6	31.8	31.7	99%	0.2	31.8
Currie Forcemain^	3.3	0.2	0.2	100%	-	0.2
Trent Forcemain	9.5	11.0	9.5	86%	1.6	11.0
Residual Solids Conveyance Line	19.1	37.0	37.0	100%	0.0	37.0
Residual Solids Pump Stations & Bridge Crossings	4.6	18.1	17.8	98%	0.4	18.1
Residual Solids Conveyance Line – Highway Crossing	-	0.3	0.3	100%	-	0.3
Contingency	16.8	1.7	-	0%	1.7	1.7
Financing	5.8	0.6	0.1	24%	0.4	0.6
Project Management Office ("PMO")	**75.8**	**72.5**	**68.8**	**95%**	**3.6**	**72.5**
Project costs Aug 2016-Dec 2016	2.2	2.2	2.2	100%	-	2.2
Owner's Engineering	17.2	18.4	17.7	96%	0.7	18.4
Conveyance Design	5.0	11.0	9.9	90%	1.1	11.0
Advisors & Professional Support	7.0	11.6	11.4	98%	0.3	11.6
Project Board	2.0	1.1	1.1	96%	0.0	1.1
Project Board Expenses	0.3	0.1	0.1	100%	-	0.1
Project Team	29.1	21.9	20.4	93%	1.6	21.9
Project Leadership Team Expenses	0.7	0.3	0.3	100%	-	0.3
Project Support Team Expenses	0.5	0.1	0.1	100%	0.0	0.1
CRD Financial Services	1.5	1.4	1.4	100%	-	1.4
CRD Human Resources	0.3	0.3	0.3	100%	-	0.3
CRD Corporate Communications	0.2	0.2	0.2	100%	-	0.2
CRD Real Estate	0.3	0.3	0.3	100%	-	0.3
CRD Information Technology	0.4	0.3	0.3	100%	-	0.3
CRD Insurance	0.1	0.0	0.0	100%	-	0.0
CRD Operations	0.6	0.6	0.6	100%	-	0.6
CRD Legislative Services	0.1	0.1	0.1	100%	-	0.1
CRD Corporate Safety	0.2	0.2	0.2	100%	-	0.2
CRD Executive Services	-	0.1	0.1	100%	-	0.1
Office Lease	1.9	1.1	1.1	96%	0.0	1.1
Office Supplies	0.1	0.2	0.2	96%	-	0.2
Vehicles	0.2	0.2	0.2	100%	-	0.2
Connections Call Center	-	0.0	0.0	100%	-	0.0
Communication support materials	0.5	0.2	0.2	100%	-	0.2
Computer Hardware, Software & Training	1.0	0.7	0.7	99%	-	0.7
Contingency	4.8	-	-	0%	-	-
BC Hydro	**12.9**	**2.7**	**2.7**	**100%**	**-**	**2.7**
Third Party Commitments	**8.1**	**8.5**	**4.6**	**54%**	**3.9**	**8.5**
Subtotal^^	**745.7**	**766.6**	**617.2**	**81%**	**149.4**	**766.6**
Program Reserves^^^	**19.2**	**8.3**	**-**	**0%**	**8.3**	**8.3**
Core Area Wastewater Treatment Project	**765.0**	**775.0**	**617.2**	**80%**	**157.8**	**775.0**

* Values presented in $millions, results in minor rounding differences

** Costs expended to April 30, 2021 includes invoices received and processed before the cut-off for the April 2021 cost period

^ In 2019, the Wastewater Treatment Project's scope was refined to remove three components of the conveyance system (expanding the capacity of the Currie Pump Station, twinning the Currie Forcemain and twinning the East Coast Interceptor), as it was determined that they would provide no benefit to the CRD's residents and businesses: see section 4.3.7.1 for further information. The expended costs on these removed components comprise costs incurred before 2016 on planning and design.

^^ While the total Project cost will not be known until total completion of all contracts, which is anticipated to occur in Q4 2021, it is forecast that the total Project cost will be approximately $766.7 M, which is within the approved budget of $775M.

^^^ A program reserve of $19.2 million was included in the Control Budget to manage risks impacting the entirety of the Project, or the interface between any of the Project components. At April 30, 2021, $8.3 million remains in program reserve; this is in addition to $2.74M of contingency that is included within the total forecast cost of $766.7M, to manage the risks associated with completing the Project-related commitments and activities that extend beyond May 2021.

Appendix C – Funding, First Nation and Land Access Agreements

Funding Agreements:

- Infrastructure Canada:
  - Building Canada Fund;
  - Green Infrastructure Fund; and
  - PPP Canada Fund;
- Province of BC; and
- Federation of Canadian Municipalities (FCM): three funding agreements (for three grants and one loan).

First Nation Agreements:

- Songhees First Nation Support Agreement;
- Esquimalt First Nation Support Agreement; and
- WSANEC Leadership Council Memorandum of Understanding.

Land Access Agreements:

- Transport Canada Licences:
  - McLoughlin Point Harbour Crossing;
  - McLoughlin Point Outfall;
- Township of Esquimalt Amenity Agreements:
  - Host Community Impact 5-Year Agreement;
  - Community Impact Mitigation and Operating Agreement; and
  - Amenity Reserve Fund Administration Agreement.
- City of Victoria Licences of Occupation:
  - Dallas Road; and
  - Clover Point Pump Station.
- Greater Victoria Harbour Authority (GVHA) Agreements:
  - Compensation Agreement; and
  - Right to Enter Agreement.
- DND Licence Agreements:
  - Access to Federal Real Property; and
  - Relocation Expenses
- Minister of Transportation and Infrastructure RSCL Highway Crossing Agreement;
- District of Saanich RSCL Infrastructure Access Agreement; and
- Rock Bay Lease Agreement.

Making a difference...together

EFE 22-33

REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE
MEETING OF WEDNESDAY, OCTOBER 12, 2022

SUBJECT **Core Area Inflow & Infiltration Program – 2022 Summary**

ISSUE

To present a summary of activities and accomplishments of the Core Area Inflow & Infiltration (I&I) Program for the period of 2021 to mid-2022, including infrastructure work carried out by the participating municipalities, and efforts related to private property I&I.

BACKGROUND

The Core Area Liquid Waste Management Plan (CALWMP) sets out goals and commitments for the municipalities, First Nations and Capital Regional District (CRD) to manage I&I through the Core Area I&I Management Plan. Each year, the Core Area I&I Program documents progress toward meeting these commitments in an annual report that is distributed to each of the core area municipalities and First Nations. This staff report summarizes the highlights of that report. The full report, *Core Area I&I Program 2022 Report*, is attached as Appendix A.

Overviews of municipal I&I actions, along with specific actions from this reporting period, are as follows:

- Colwood diligently inspects its new underground infrastructure to manage and prevent I&I. In 2021 and 2022, Colwood updated its Sewer Master Plan and its sanitary sewer model. As part of the work, sewer flow data loggers were installed at three municipal pump stations and at the Department of National Defence's Belmont pump station. These meters were later purchased by the CRD for long-term data collection at these pump stations.

- Esquimalt completed a municipal I&I Management Plan, which includes a detailed 10-year plan for addressing I&I and reducing flows below 4xADWF (average dry weather flow) by 2030. Next steps include assessing funding mechanisms to pay for the work and updating bylaws to enable progress regarding private property I&I. In 2021-2022, Esquimalt carried out spot repairs to prevent structural failures of sewer and stormwater pipes at various locations on Esquimalt Road and Lampson Street. It also installed or repaired 44 sanitary laterals, 32 stormwater laterals and five catch basins. Working with the CRD, Esquimalt identified and removed a sewer cross-connection to the Gorge Waterway.

- Langford has a rapidly expanding new sewer system. Langford diligently inspects new connections and is incentivized to monitor and repair the sewer system to preserve sewer capacity for future growth. Since mid-2021, Langford repaired 33 inspection chambers, plugged or sealed approximately 30 leaky sewer manholes, video inspected 6 inspection chambers and repaired or replaced three sewer manhole frames and covers. In late 2022, Langford plans to camera inspect the sewer mains around Florence Lake and Setchfield and to investigate the Happy Valley catchment for I&I during the fall rains.

- In 2021 to mid-2022, Oak Bay completed a Sanitary Sewer master plan and is currently undertaking a Storm Drain master plan. Reports were completed (or in progress) for addressing sewer upgrades around Beach Drive, Dalhousie, Orchard and Sandowne. Oak Bay added, repaired or replaced approximately 600 meters of sanitary sewer pipe, 12 sewer manholes and 50 laterals to the property line, complete with inspection chamber. Oak Bay dye tested 128 laterals and found 20 cross connections, 12 of which were fixed. It also disconnected several overflows from manholes, removed several abandoned sewer lateral connections and rehabilitated various parts of its storm drain system. The District has been unsuccessful in securing grant money for the sewer separation project in the Humber catchment area, which the Province has specified must be completed by the end of 2025.

- Saanich continues its sewer maintenance and repair program, including camera inspections, sewer relining, smoke testing and flow monitoring. In 2021-2022, Saanich repaired or replaced 1,951 meters of sanitary sewer, 251 sewer connections (with inspection chambers) and seven manholes. It also camera inspected 33,500 meters of sewer main and performed three spot repairs. In the Wetherby Sanitary Lift Station catchment, Saanich smoke tested 2,671 meters of sewer, which led to 22 I&I related repairs. Other key initiatives included the development and calibration of an updated sanitary sewer model and the development of a program for inspecting and replacing “no-corrode” (tarpaper) sewer laterals.

- Victoria continues to manage its sewer repair and replacement work according to its sewer master plan. In 2021-2022, Victoria relined or replaced 2,740 meters of sewer pipe, eight manholes and 189 sewer laterals. It camera inspected 40 kilometers of sanitary sewer mains and 1,044 sewer laterals. It carried out 650 detailed manhole inspections, added 25 inspection chambers and fixed three cross-connections. Victoria completed a report entitled “Comprehensive Inflow and Infiltration Reduction Plan: Public- and Private-Side Actions”, which was presented to its city council in November 2021.

- View Royal continued its programs related to sewer maintenance and repairs, camera inspections, sewer flushing and flow monitoring. In 2021-2022, View Royal camera-inspected and flushed 2,976 meters of sewer pipe, inspected 292 sewer manholes and identified and repaired one residential cross-connection. View Royal is in the process of upgrading the Helmcken Bay pump station, which will include the addition of a flow meter.

- Esquimalt Nation continues to perform routine maintenance on its sewer and stormwater systems and is awaiting funding for more significant work that was recommended in a 2018 consultant’s report.

- Songhees Nation does routine sewer maintenance and repairs, as needed. In 2015, the Nation hired a consultant to investigate its sewer system for I&I sources and to provide detailed designs for remediation. The work is ready for tender and awaiting funding from Indigenous Services Canada.

Through the Core Area I&I Program, the CRD continues to work with its municipal and First Nations partners on I&I-related management and reduction efforts. This includes regional flow monitoring, standardizing I&I approaches, preparing management plans and annual reports, education programs and private property I&I initiatives. This also involves coordination with municipalities and national organizations that are dealing with similar issues. Key actions completed in 2021-2022 include:

- working on the 5-year update to the I&I Management Plan for submission in early 2023
- updating I&I rates for the core area. Appendix B contains a map summarizing these rates
- comparing measured flows to the sewer flow allocations in Bylaw No. 4304 (Appendix C)
- update of a report documenting the status of existing municipal private property I&I programs from around North America; this report is included as an appendix in the Core Area I&I Program 2022 Report.

The work accomplished by all participants will continue to support the regional effort to control and reduce municipal I&I flow rates; however, continued and focused work is still needed to meet the CALWMP commitment of reducing wet weather flows below four times average dry weather flow at the Clover Point and McLoughlin Point wastewater treatment plants by 2030. Municipalities that contribute to Clover Point with older sewers, and inherently higher I&I, will need to allocate additional resources and accelerate efforts to meet their respective I&I reduction targets.

IMPLICATIONS

Environmental & Climate Implications

The work documented in the report supports CALWMP commitments related to reducing overflows, which will have a positive impact on local creeks, beaches and ecosystems.

Intergovernmental Implications

As a condition of the Ministry of Environment & Climate Change Strategy's (ENV) conditional approval of Amendment 12 to the CALWMP, the CRD was required to submit an amendment to the commitments pertaining to management of I&I and sanitary sewer overflows for ENV approval by December 31, 2021. Staff have advised ENV that updating the CALWMP I&I and sanitary overflow commitments will be delayed, pending:

1. Operation of all new core area wastewater treatment and conveyance infrastructure during two wet-weather seasons to confirm modelled predictions for sanitary flows, I&I and overflows.
2. Submission of updated detailed municipal I&I management plans, currently anticipated for Q1 2023.

In addition to the above, the CRD is currently preparing to update the CALWMP, which will also require an amendment process approved by ENV. The CRD's current planning process anticipates the update to be prepared for submission in 2023, and staff expect to include the above amendment at that time.

Social Implications

Reduced I&I and overflows will reduce the number of beach closures and impacts on the natural environment. Public education and outreach programs for residents and businesses raise awareness of the issues and provide greater understanding of how everyone can contribute to I&I reduction.

Financial Implications

The CRD engages with core area municipalities and First Nations to identify and reduce the amount of rain and groundwater that enters the sanitary sewer system. The core budget for this program is $425,000.

Municipal infrastructure repair initiatives are funded by the respective municipality. Monitoring, reporting, strategy and leadership are facilitated by the CRD I&I program.

CONCLUSION

This staff report summarizes the Inflow & Infiltration (I&I) related activities and accomplishments of the Core Area I&I Program, participating municipalities and First Nations for 2021 to mid-2022. While much work has been done to date, modelling indicates that sub five-year overflows will continue at the Clover Point long outfall. The municipalities that contribute to these overflows will need to enhance their efforts on I&I reduction to meet the commitment in the CALWMP to prevent overflows for less than five-year rainfall events by 2030. The annual report will be forwarded to the core area municipal engineers for use in their I&I reduction programs.

RECOMMENDATION

There is no recommendation. This report is for information only.

Submitted by:	Stephen May, P.Eng., Senior Manager, Facilities Management & Engineering Services
Concurrence:	Larisa Hutcheson, P.Eng., General Manager, Parks & Environmental Services
Concurrence:	Robert Lapham, MCIP, RPP, Chief Administrative Officer

ATTACHMENTS

Appendix A: Core Area Inflow & Infiltration Program – 2022 Report (October 2022)
Appendix B: Map Summarizing Inflow & Infiltration in the Capital Regional District's Core Area
Appendix C: Table Comparing Measured Flows to Allocated Flows in Bylaw No. 4304

APPENDIX A

Core Area Inflow & Infiltration Program - 2022 Report

Capital Regional District | October 2022

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CORE AREA INFLOW & INFILTRATION PROGRAM

2022 REPORT

EXECUTIVE SUMMARY

The Core Area Liquid Waste Management Plan (CALWMP) sets out goals and commitments for the municipalities, First Nations and Capital Regional District (CRD) to manage I&I through the Core Area I&I Management Plan. The Core Area I&I 2022 Report documents progress toward meeting these commitments for the period of 2021 to mid-2022.

In general, municipalities with aging sewer infrastructure are addressing areas with elevated I&I through sewer catchment analysis, investigations, rehabilitation and targeted sewer renewal. The municipalities with newer sewer infrastructure are focusing on I&I prevention. Overviews of municipal I&I actions, along with specific actions from this reporting period, are as follows:

- Colwood diligently inspects its new underground infrastructure to manage and prevent I&I. In 2021 and 2022, Colwood updated its Sewer Master Plan and its sanitary sewer model. As part of the work, sewer flow data loggers were installed at three municipal pump stations and at the Department of National Defence's Belmont pump station. These meters were later purchased by the CRD for long-term data collection at these pump stations.

- Esquimalt completed a municipal I&I Management Plan that includes a detailed 10-year plan for addressing I&I and reducing flows below 4xADWF (average dry weather flow) by 2030. Next steps include assessing funding mechanisms to pay for the work and updating bylaws to enable progress regarding private property I&I. In 2021-2022, Esquimalt carried out spot repairs to prevent structural failures of sewer and stormwater pipes at various locations on Esquimalt Road and Lampson Street. It also installed or repaired 44 sanitary laterals, 32 stormwater laterals and 5 catch basins. Working with the CRD, Esquimalt identified and removed a sewer cross-connection to the Gorge Waterway.

- Langford has a rapidly expanding new sewer system. Langford diligently inspects new connections and is incentivized to monitor and repair the sewer system to preserve sewer capacity for future growth. Since mid-2021, Langford repaired 33 inspection chambers, plugged or sealed approximately 30 leaky sewer manholes, video inspected 6 inspection chambers and repaired or replaced 3 sewer manhole frames and covers. In late 2022, Langford plans to camera inspect the sewer mains around Florence Lake and Setchfield and to investigate the Happy Valley catchment for I&I during the fall rains.

- In 2021 to mid-2022, Oak Bay completed a Sanitary Sewer master plan and is currently undertaking a Storm Drain master plan. Reports were completed (or in progress) for addressing sewer upgrades around Beach Drive, Dalhousie, Orchard and Sandowne. Oak Bay added, repaired or replaced approximately 600 meters of sanitary sewer pipe, 12 sewer manholes and 50 laterals to the property line with inspection chamber. Oak Bay dye tested 128 laterals and found 20 cross connections, 12 of which were fixed. It also disconnected several overflows from manholes, removed several abandoned sewer lateral connections and rehabilitated various parts of its storm drain system.

- Saanich continues its sewer maintenance and repair program, including camera inspections, sewer relining, smoke testing and flow monitoring. In 2021-2022, Saanich repaired or replaced 1,951 meters of sanitary sewer, 251 sewer connections (with inspection chambers) and 7 manholes. It also camera inspected 33,500 meters of sewer main and performed 3 spot repairs. In the Wetherby Sanitary Lift Station catchment, Saanich smoke tested 2,671 meters of sewer, which led to 22 I&I-related repairs. Other key initiatives included the development and calibration of an updated sanitary sewer model and the development of a program for inspecting and replacing "no-corrode" (tarpaper) sewer laterals.

- Victoria continues to manage its sewer repair and replacement work according to its sewer master plan. In 2021-2022, Victoria relined or replaced 2,740 meters of sewer pipe, 8 manholes and 189 sewer laterals. It camera inspected 40 kilometers of sanitary sewer mains and 1,044 sewer laterals. It carried out 650 detailed manhole inspections, added 25 inspection chambers and fixed three cross-connections. Victoria completed a report entitled “Comprehensive Inflow and Infiltration Reduction Plan: Public- and Private-Side Actions”, which was presented to city council in November 2021.

- View Royal continued its programs related to sewer maintenance and repairs, camera inspections, sewer flushing and flow monitoring. In 2021-2022, View Royal camera-inspected and flushed 2,976 metres of sewer pipe, inspected 292 sewer manholes and identified and repaired one residential cross-connection. View Royal is in the process of upgrading the Helmcken Bay pump station, which will include the addition of a flow meter.

- Esquimalt Nation hired a consultant to inspect their sewer system and prepare a report containing recommendations for maintenance, repairs, and I&I reduction in 2018. In 2019 and 2020, the First Nation removed/capped four unused sewer laterals, completed a point repair, grouted a manhole and renewed its pump station. Further work will require funding from Indigenous Services Canada.

- Songhees Nation does routine sewer maintenance and repairs, as needed. In 2015, the Nation hired a consultant to investigate its sewer system for I&I sources and to provide detailed designs for remediation. The work is ready for tender and awaiting funding from Indigenous Services Canada.

Through the Core Area I&I Program, the CRD continues to work with its municipal and First Nations partners on I&I-related management and reduction efforts. This includes regional flow monitoring, standardizing I&I approaches, preparing management plans and annual reports, education programs and private property I&I initiatives. This also involves coordination with municipalities and national organizations that are dealing with similar issues. Key actions completed in 2021-2022 include:

- working on the 5-year update to the I&I Management Plan for submission in early 2023
- updating I&I rates for the core area. The results are summarized in Section 5; the analyses will be documented in updated I&I Management Plan
- comparing measured flows to the sewer flow allocations in Bylaw No. 4304 (Section 6)
- update of a report documenting the status of existing municipal private property I&I programs from around North America

The work accomplished by all participants will continue to support the regional effort to control and reduce municipal I&I flow rates; however, continued and focused work is still needed to meet the CALWMP commitment of reducing wet weather flows below four times average dry weather flow at the Clover Point and McLoughlin Point wastewater treatment plants by 2030. Municipalities that contribute to Clover Point with older sewers, and inherently higher I&I, will need to allocate additional resources and accelerate efforts to meet their respective I&I reduction targets.

1. BACKGROUND

1.1 Overview

The CRD completed a CALWMP in July 2000 to serve the municipalities of Colwood, Esquimalt, Langford, Oak Bay, Saanich, Victoria, View Royal, Esquimalt Nation and Songhees Nation. The plan provides a strategy for managing liquid waste and was approved by the Ministry of Environment. Section 5 of the CALWMP addresses the *Management of Infiltration and Inflow and Control of Wastewater Overflows* (see Appendix A).

Each year, the CRD's Core Area Liquid Waste Management Committee, comprised of core area representatives, submits a CALWMP status report to the Province. In order to prepare this report, the Committee requires annual reports from the CRD departments involved in the implementation of the CALWMP. This report provides the update for the Core Area I&I Program and includes data from 2021 to mid-2022. The report is divided as follows:

- Section 1 - Background
- Section 2 – I&I Program Initiatives
- Section 3 - Municipal and First Nations I&I Initiatives
- Section 4 – Overflows
- Section 5 – I&I Rates for the Core Area
- Section 6 – Sewer Allocations
- Section 7 – Summary

1.2 Study Area

The CRD's core area is a partnership of seven local governments and two First Nation areas. These include Colwood, Esquimalt, Langford, Oak Bay, Saanich, Victoria, View Royal, the Esquimalt Nation and the Songhees Nation. The core area has a total land area of about 215 km^2 and a population of approximately 320,000 people.

In the core area, municipal sewer flows are discharged into CRD trunk sewers. Prior to December 2020, these trunk sewers conveyed sewage to either the Clover or Macaulay point pump stations, where the flows were screened and pumped out through deep sea outfalls. As of December 2020, the flows are conveyed to a treatment plant located at McLaughlin Point.

A map of the core area sewers is located in Figure 1.1. The Clover Long outfall is shown on the map because sewer modelling predicts that it will be the only location that overflows for sub 5-year rainfall events. A summary of sewer infrastructure in the core area is located in Table 1.1.

Figure 1.1: Map of the Capital Regional District Core Area

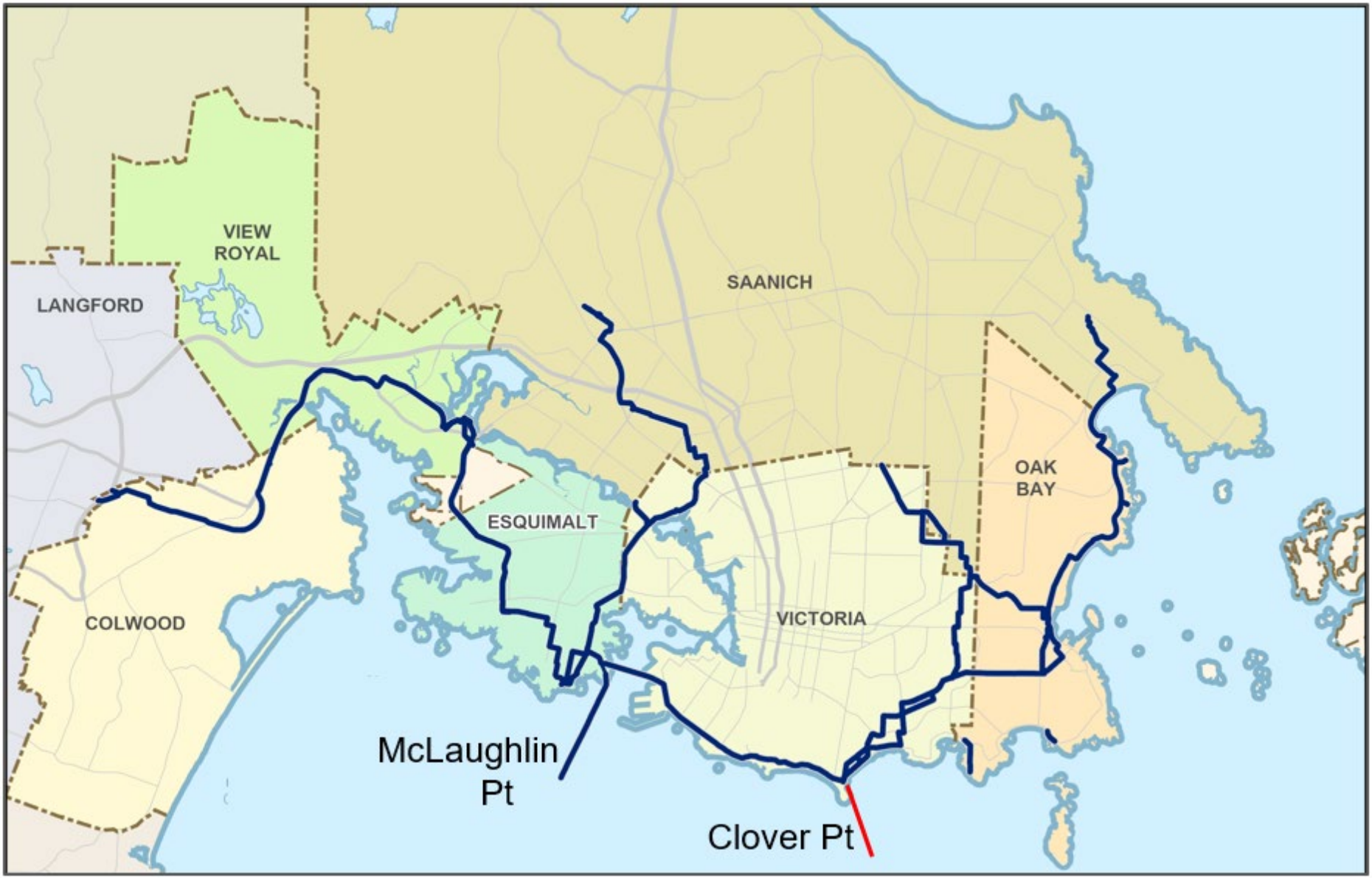


Table 1.1: Sewer Infrastructure in the CRD Core Area

** Excludes Hartland Landfill site, but includes Hartland Leachate Line*

Jurisdiction		Gravity Sewers (km)	Force Mains (km)	Man holes	Pump Stations	Laterals **	Average Pipe Age *** (years)	% Developed Properties Connected to Sewer
Colwood	Municipal	37.1	7.3	568	10	2159	19	45%
	Private	5.2	3.7	120	12		20	
	Gov't of Canada	6.7	2.7	125	6		31	
Esquimalt	Municipal	56.8	4.0	874	12	3404	55	100%
	Private	0.2	0.0	3	0		86	
	Gov't of Canada	15.6	4.5	368	23		50	
Langford	Municipal	117.5	22.1	1769	14	8522	16	83%
	Private	11.4	2.1	167	10		15	
Oak Bay	Municipal	100.2	2.0	1312	7	3813	75	100%
	Private	2.4	1.4	32	3		27	
Saanich	Municipal	550.3	19.3	6474	36	29,475	40	94%
	Private	7.1	0.0	121	0		32	
Victoria	Municipal	233.3	3.2	2855	12	13676	94	100%
	Private	0.0	0.0	3	2		N/A	
View Royal	Municipal	44.7	5.8	864	17	2119	34	96%
	Private	2.4	0.6	33	5		17	
First Nations	Esquimalt	1.4	0.3	22	1	N/A	27	100%
	Songhees	N/A	0.3	N/A	1	N/A	N/A	99%
CRD Owned *		51.9	48.2	293	16	3	22	N/A
Total		1,247	128	15,979	200	62,646		

*** Some estimated*

**** Includes both gravity and force mains*

1.3 Core Area I&I Program

The I&I program is guided by the Core Area I&I Subcommittee, which was established in the mid-1990s to work regionally to identify various methods of reducing and controlling I&I. The subcommittee comprises representatives from the CRD, Colwood, Esquimalt, Langford, Oak Bay, Saanich, Victoria and View Royal, and typically meets several times per year.

I&I program staff provide educational services to the public and technical support to municipalities to help promote reduction of the amount of rainwater and groundwater entering the sanitary sewer system to achieve the CALWMP commitment of reducing wet weather flows below four times average dry weather flow at Clover Point and the McLoughlin Point wastewater treatment plant by 2030.

The goals of the program are to:

- assist members with regulatory compliance
- coordinate and analyze regional flow monitoring and analysis
- promote the inspection and repair of private property laterals through education

- assist with prioritization of I&I reduction work required to reduce sewage overflows
- support sewer asset management programs
- support efforts to maintain sewer capacity needed for future growth, densification and climate change

I&I program staff carry out a variety of I&I specific tasks, including:

- preparing annual I&I reports, I&I Management Plans and Overflow Management Plan updates
- developing and analyzing flow meter data for I&I analyses
- assisting municipalities with tasks related to I&I reduction
- developing and executing private property I&I initiatives
- efforts to improve the ongoing quality of flow data and rainfall data
- national leadership in I&I initiatives, such as private property initiatives and benchmarking
- working in collaboration with Metro Vancouver and other neighboring jurisdictions
- working with Integrated Water Services (IWS) to generate monthly wastewater flow/I&I reports for each core area municipality and First Nation (aimed at municipal engineering staff and First Nations administration).
- working with IWS, vetting core area SCADA sewer flow data for use in annual cost sharing, monthly reports, etc.

1.4 Past Reports

Since 2001, a regional effort of flow monitoring and analysis has been undertaken, resulting in many regional initiatives. The results of this work are documented in reports summarized in Table 1.2. Of key interest are the I&I Management Plan – see executive summary in Appendix B.

Table 1.2: Key Program Reports by Year

Year	Reports Completed
2005	• I&I Analyses Results Report: October 2001 to March 2004 • Biennial Report for the Ministry
2006	• I&I Analyses Results Report: October 2004 to April 2005
2007	• I&I Analyses Results Report: October 2005 to April 2006 • Biennial Report for the Ministry
2008	• Overflow Management Plan • I&I Analyses Results Report: October 2008 to March 2010
2009	• Biennial Report for the Ministry
2010	• I&I Analyses Results Report: October 2010 to March 2012
2011	• n/a
2012	• I&I Management Plan
2013	• Annual Reports for 2012
2014	• Overflow Management Plan: 5 Year Update • Annual Reports for 2013
2015	• Annual Reports for 2014
2016	• n/a
2017	• Annual Reports for 2016 • I&I Management Plan: 5 Year Update (included annual report for 2015)
2018	• Annual Reports for 2017
2019	• 2019 Annual Report (includes info for 2018 to mid-2019)
2020	• 2020 Annual Report (includes info for 2019 to mid-2020)
2021	• 2021 Annual Report (includes info for 2020 to mid-2021)

2. I&I PROGRAM INITIATIVES

2.1 General Initiatives

I&I Management Plan 5-year Update

The core area I&I Management Plan is updated every 5 years. The last update was submitted to the Province in 2017. The 5-year update will be complete in late 2022. Key additions include:

- using the core area sewer model (built in 2018) to predict overflow locations and volumes for different return period storms and climate change scenarios
- comparing measured sewer flows to allocated sewer flows in the CRD sewer bylaw
- more specific municipal I&I reduction plans
- the updated I&I education approach
- full I&I analyses of ~80 flow metering sites

2.2 Private Property I&I and Education Initiatives

In North America, it is often estimated that half of all I&I comes from private properties. As such, it is important that municipalities adopt strategies for addressing it; however, addressing private property I&I has proven difficult for the following reasons:

1. It's uncommon.
   - the only municipalities with significant approaches for dealing with private property I&I are a small number of American municipalities that were required to address it to avoid substantial fines from regulators (i.e., the EPA)

2. It is expensive
   - finding problems is expensive (e.g., $250 for a camera inspection per property)
   - addressing the problems can cost thousands of dollars
   - who pays, etc.?

3. Liability
   - requiring or carrying out work on property brings potential liabilities to the municipality

4. It's complicated
   - private property I&I is only a significant problem if the overall catchment has an I&I problem
   - cross-connections (inflow) may be the main source of "fast" I&I in these catchments but finding cross-connections is complex
   - lateral replacement programs are theoretically easier to set up; however, the downside is that they generally apply to all properties, not just properties in catchments with high I&I; (note that for a private property lateral to be a source of infiltration, the groundwater table needs to be higher than the level of the lateral, which may not be the case)

The CRD's I&I program staff continue to work toward workable private property I&I options for the core area. The work completed prior to 2021 is chronicled by year in Appendix C. Key work completed in 2021 to mid-2022 includes:

Update of the Private Property I&I Options from North America

In 2011, the CRD commissioned a report summarizing the private property I&I programs used across North America. In 2014, the CRD updated this report to answer additional questions and to increase the focus on what's happening in Canada. In 2021-2022, the CRD hired a consultant to update this report. The consultant contacted the municipalities noted in the previous versions of the report to determine the current status of their I&I programs, lessons learned, etc. A copy of the updated report is located in Appendix E.

2.3 Education

CRD staff have taken steps to educate the public on the topic of I&I. One goal of the program is to encourage home owners to camera-inspect and maintain their underground sewer lateral, which will result in lower private property I&I. A second goal is to provide education showing where I&I comes from and the problems it creates, so that when funding is required and/or rehabilitation work is proposed in local neighborhoods, the public has a better understanding of why the work is required. The work completed prior to 2021 is chronicled by year in Appendix D.

Due to the pandemic, minimal education work was completed during the last two years. The education materials and approach are ready for implementation but are designed to be implemented in person with a focus on key stakeholder groups. For example, the education approach includes presentations at realtor offices as part of their monthly "lunch and learns". These were put on hold during the pandemic. Online presentations to this group were determined to be far less effective.

2.4 Future Initiatives

Table 2.1: Anticipated Next Steps for Supporting I&I Reduction

Action	Description / Timeline
Assessing the Accuracy of Municipal Pump Station Flow Data – Phase 2	• In 2021, a project was carried out to check the accuracy of municipal pump station flow data generated by the I&I program (Phase 1). For a small number of pump stations, it was found that the methods used to create the flow data were not suitable. The purpose of Phase 2 is to assess options for getting reliable flow data for these pump stations.
Rain Gauge Network Review / Calibration Checks	• Rainfall data is critical to I&I calculations. The purpose of the project will be to do calibration checks of each of the core area owned rain gauges and to confirm that data is being stored accurately in SCADA.
Pump Station Flow Data for Saanich	• Saanich currently cannot derive sewer flow data from its pump stations. The CRD and its consultants will work with Saanich to assess options and may provide resources for implementation.
Municipal Pump Station Real Time Flows / I&I Monitoring	• Sewer flow data for a number of municipal pump stations is currently generated every few years using SCADA data (i.e., wetwell levels and pump starts/stops.) The calculations are already setup online. The process can be updated to generate the flow data in real-time, with minimal additional setup cost. A benefit of doing this is that the flows can be monitored in real-time for I&I.
Interactive Display	• Finalize an interactive I&I display for outreach events aimed at the general public, etc.
Data collection, investigation and planning to address catchments that exceed their sewer allocations	• Focus on catchments that exceed their allocations in Oak Bay and Victoria. (Similar work was already funded by the CRD for Esquimalt (Section 2.6) • Includes finalizing the pilot project that involved sewer investigation work in three Oak Bay catchments with high I&I. The work included camera inspections, smoke testing and manhole inspections. The final step is to follow up on the smoke testing results to find the specific defects resulting in the "errant smoke".

3. MUNICIPAL & FIRST NATIONS INITIATIVES

Colwood

Colwood diligently inspects its new underground infrastructure to manage and prevent I&I. In 2021 and 2022, Colwood updated its Sewer Master Plan and its sanitary sewer model. As part of the work, sewer flow data loggers were installed at three of Colwood's municipal pump stations and the Department of National Defence's Belmont pump station. These meters were later purchased by the CRD and they continue to collect data for future use. Considerable cost saving were achieved because the meters were already installed and the online data service was already setup.

Esquimalt

Esquimalt I&I Reduction Plan Project

In 2021 to mid-2022, Esquimalt worked on the following I&I-related actions:

- completed the I&I Management Plan, which includes a 10-year plan to address I&I concerns and reduce flows below 4xADWF
- carried out spot repairs to main lines of both the storm and sanitary collection system due to structural failure at various locations on Esquimalt Road and Lampson Street; design of further repairs on Lampson Street, Munro Street and a new forcemain in Saxe Point is complete, with construction expected in fall 2022
- installed 22 new sanitary laterals, 19 new stormwater laterals and 5 catch basins
- repaired or replaced 22 sewer laterals and 13 stormwater laterals that were impacted by blockages or failures
- released a tender in late 2021 for cleaning, inspection and service ratings of the remaining portions of the storm and sanitary collection systems; completion of the work is expected by the end of 2022
- continued working with CRD Source Control to find possible cross connections into the Gorge Waterway; in 2021-2022, one direct cross connection was removed as a result of this work
- determine a funding mechanism/bylaw for addressing I&I from both public and private property sewers and laterals (late 2022/early 2023)
- adopt a bylaw (late 2022/early 2023) to provide a mechanism for the Township to deal with private property laterals; work will be focused on a review of the draft model bylaw from the CRD, cost for works and how the works will be carried out; it will also determine a mechanism that will allow work to occur on private property and how the costs associated with these activities will be allocated between the various stakeholders involved

Langford

Langford has a rapidly expanding new sewer system. It diligently inspects new connections and is incentivized to monitor and repair the sewer system to preserve sewer capacity for future growth. Since mid-2021, Langford carried out the following I&I related actions:

- repaired 33 inspection chambers, including repairs to lids, collars, boxes, etc.
- plugged or sealed approximately 30 sewer manholes along with frame reinstatement
- video inspected 6 inspection chambers
- repaired or replaced 3 sewer manhole frames and covers
- annual CCTV work is scheduled for fall 2022, with a focus on areas around Florence Lake, Setchfield; I&I specific inspections are planned for the Happy Valley catchment during the fall rains

Oak Bay

Oak Bay's capital projects included:

Windsor Sanitary - Phase 1
- replaced 186 meters of clay pipe (200 millimetre) with larger PVC pipe (300 millimetre)
- added 5 new sanitary manholes
- added 1 new lateral to the property line with an inspection chamber
- reconnected 11 sanitary sewer laterals with new wyes
- disconnected several overflows from manholes
- removed several abandoned connections to the sewer system

Windsor Sanitary - Phase 2
- replaced 314 meters of clay pipe (200 millimetre) with larger PVC pipe (300 millimetre)
- added 5 new sanitary manholes
- reconnected 27 sanitary sewers laterals with new wyes
- reconnected 2 storm sewer laterals sewers with new wyes
- disconnected several overflows from manholes
- removed several abandoned connections to the sewer system

Storm Drain Work
- in the Thompson storm drain, installed 2 new manholes, 112 meters of new storm mains, 4 catch basins, 4 sewer laterals to properly line with inspection chambers; also reconnected 1 storm drain lateral at the storm main
- in the Mayhew storm drain, installed 38 meters of storm main, 3 new storm drain manholes and 2 catch basins.

Consultant Reports and Projects (In Progress)
- Beach Drive Sanitary Sewer Feasibility Study and Options analysis
- Dalhousie Sanitary: survey, design, tender for approximately 578 meters of new sewer main, 220 meters of new storm main plus related lateral reconnections & new/replaced catch basins
- storm drain master plan

Consultant Reports and Projects (Complete)
- Sandowne Storm & Sanitary Network Analysis: Functional Level Upgrading Design for Sandowne Easement catchment
- Orchard/Newport Storm Water Model Development Report
- sanitary sewer master plan

Sewer Work Focused on Trenchless Technology (i.e. pipe bursting)
- in the Mountjoy area, 38 meters of storm main was pipe bursted and crews replaced 1 catch basin and 2 storm laterals
- in the Uplands sewer easement, 90 meters of combined sewer was pipe bursted, 4 sewer laterals were reconnected and 1 new sanitary sewer manhole was added.

Notable Maintenance carried out by Public Works
- completed 10 storm main spot repairs and 5 sewer main stop repairs
- repaired 2 storm sewer manholes and two sanitary sewer manholes
- repaired 1 stormwater lateral and 2 sewer laterals
- on the Island Road storm drain, replaced 55 meters of clay pipe (100 millimetre) with larger PVC Pipe (200 millimetre) and installed 1 new storm manhole
- flushed 9.8 kilometers of storm mains and 16.5 kilometers of sewer main

Oak Bay's engineering records show that:

- 35 new sewer laterals were installed and 12 were replaced
- 57 new storm laterals were installed and 6 were replaced
- note that the above numbers include services for 28 new buildings
- Oak Bay dye tested 128 laterals and found 20 cross connections, 12 of which have been fixed

Note that some of this work overlaps calendar years and thus may be documented in I&I Annual Reports for consecutive years.

Saanich

Saanich replaces and renews its sanitary sewer infrastructure through its capital and maintenance programs. The following capital and maintenance activities were completed in 2021-2022:

- camera inspected and assessed 33,512 meters of sanitary sewer main and 12,122 meters of checklist lines (lines requiring frequently scheduled maintenance)
- replaced 1,951 meters of sanitary sewer along with 142 new sewer service connections and inspection chambers
- repaired 23 sewer service connections and replaced an additional 7; as part of this work, 5 new inspection chambers were installed
- repaired 7 manholes
- completed spot repairs on 3 sewer mains
- lined 79 sewer service connections
- smoke tested 2,671 meters of sanitary sewer in the Wetherby Sanitary Lift Station catchment and repaired 22 of the 25 identified I&I issues
- camera inspected and smoke tested the Cordova Bay Lift Station; 3 I&I issues were identified and repairs are being planned
- removed and abandoned three aging lift stations; as part of this work, 17 sewer service connections were replaced with new low pressure systems (62 meters of sanitary sewer forcemain)
- inspected 67 potential no corrode sanitary service connections

The following planning initiatives were completed in 2021-2022:

- developed and calibrated an updated sanitary sewer model; the work included flow monitoring of key locations and contained recommendations for addressing system deficiencies and prioritize planning initiatives
- developed a "no-corrode sewer lateral inspection and replacement program"
- flow metered the Brett Lift Station, Wetherby Lift Station and Ash Lift Station catchments to identify peak wet weather flows and I&I values

Work in progress in mid-2022 included:

- camera inspecting the remaining 23,035 metres of Saanich's checklist lines (lines requiring frequently scheduled maintenance)
- camera inspection program planning for Saanich's critical sanitary sewers
- Planning the replacement of two sewer pump stations
- Inspecting the 56 remaining potential no corrode sanitary service connections and developing a "no- corrode" replacement strategy
- operational reviews of the Beach Park and Albina Lift Stations, including smoke testing of their catchments
- developing an internal flow monitoring program operating procedure
- sewer lining projects for two sanitary sewer lift station wet wells with high I&I

Victoria

City of Victoria continues to manage its sewer repair and replacement of its infrastructure as part of Sewer Master Plan, which was fully updated in 2018. Highlights of the I&I-related work carried out in 2021 are summarized as follows:

- a comprehensive I&I reduction on private properties report was prepared by Urban System Ltd and presented to Council in November 2021
- 2 FloDar flow meters with special sensors were installed that allow peak flows to be monitored during surcharge conditions
- City of Victoria staff camera inspected 18.5 kilometers of sanitary sewer mains; contractors inspected an additional 12.4 kilometers of sewer mains and 887 sanitary sewer laterals
- 63.9 kilometers of sanitary sewer mains were cleaned by City staff
- 1,553 meters of sanitary sewer mains were lined using cured in place technology; the work included the replacement of 2 sanitary sewer vents and 2 sanitary sewer flush tanks with standard terminal manholes
- City staff replaced 7 sanitary sewer manholes and 55 sewer laterals
- City staff repaired 34.4 meters of sewer mains and 28 sewer laterals
- 24 sanitary sewer laterals were relined using T-liner technology, with the focus on sealing the main/lateral interface; as part of this work, 17 inspection chambers were also installed
- 1,034 meters of sanitary sewer mains was replaced by open trench excavation
- approximately 650 sewer manholes were inspected using a 3D camera and Manhole Assessment Certification Program level 2 reports were generated for each
- the Disaster Mitigation and Adaptation Fund program under a federal grant has commenced; the program's goal is to upgrade select sewer, storm drain and water main infrastructure over the next 9 years to address challenges due to natural hazards (e.g., earthquakes, climate change, as well as increased demand); the design and construction work started in late 2020 and will continue until 2028
- the City has applied for the Investing in Canada Infrastructure Program grant to fund design and construction of new alignment of sanitary sewer mains and to separate the combined manholes where both the sanitary sewer and storm drain lines run side by side; this program's intent is to reduce I&I
- the City continues to address and evaluate the I&I issues associated with private properties; this includes the building permit related requirement for all new developments to obtain the separate storm drain connection and consider rainwater management system on private property; all permits associated with major renovations are required to confirm their connections to the City's storm drain system via inspections or dye tests to determine if the property may require a new storm drain connection

Highlights of the City of Victoria's I&I-related work carried out in the first half of 2022 are summarized as follows:

- City of Victoria staff camera inspected 7,100 meters of sanitary sewer mains; contractors inspected an additional 2,133 meters of sewer mains and 157 sanitary sewer laterals
- 27,550 meters of sanitary sewer mains were cleaned by City staff
- 1,510 meters of sanitary sewer mains will be lined using cured in place technology under the City's annual lining contractor
- 1 sanitary sewer manhole was replaced
- 50 meters of sanitary sewer mains were repaired by City staff
- 19 sewer laterals were repaired and 36 sanitary sewer laterals have been replaced by City staff
- 27 sanitary sewer laterals were relined by T-liner technology with the focus on sealing the main/lateral interface; as part of this work, 8 inspection chambers were also installed
- 270 linear meters of sanitary sewer main were replaced by open trench excavation
- 3 cross connected inflow catch basins were fixed

View Royal

View Royal continues its sewer maintenance and repair program, which includes camera inspections, sewer flushing and flow monitoring. In 2021 to mid-2022, View Royal has completed the following sewer work related to I&I:

- camera-inspected and flushed 2976 meters of sewer main
- inspected 292 sewer manholes
- identified and repaired one residential sewer cross connection
- replaced two sewer gate valves on the Helmcken Bay sewer force main
- started upgrading the Helmcken Bay pump station, which will include the addition of a flow meter

Esquimalt First Nation

In 2018, the Esquimalt Nation hired a consultant to inspect its sewer system and prepare a report containing recommendations for maintenance, repairs and I&I reduction. In 2019 and 2020, the First Nation removed/capped four unused sewer laterals, completed a point repair, grouted a manhole and renewed its pump station. Further work will require funding from Indigenous Services Canada.

Songhees First Nation

Songhees Nation does routine sewer maintenance and repairs, as needed. In 2015, the Nation hired a consultant to investigate its sewer system for I&I sources and to provide detailed designs for remediation. The work is ready for tender and awaiting funding from Indigenous Services Canada.

4. OVERFLOWS

4.1 Overview

Sanitary sewer overflows are releases of raw sewage into storm drains and/or local waterways. The majority of sewer overflows occur during heavy rainfall events as a result of I&I overwhelming the capacity of the sewer system. Overflows may also occur as a result of sewer blockage, pipe failure and pump station failures.

Sewer overflows can expose people, pets and the environment to sewage, harmful chemicals, infectious bacteria, viruses, parasites, etc. The risks associated with sewage releases are influenced by the following characteristics of the receiving environments:

- public use (e.g., shoreline access, kayaking, swimming, shellfish harvesting)
- habitat sensitivity (e.g., productive or endangered habitats such as shellfish areas, kelp beds and herring spawning sites)
- flushing characteristics (e.g., exposed coast line or in-land waters)

Reducing I&I will decrease the frequency, volume and duration of sewer overflows.

4.2 Reported Overflows

CRD staff monitor regional overflow points with overflow sensors. The core area municipalities monitor their pump stations for overflows. When overflows occur, they are investigated, documented and reported to Emergency Management BC.

Figure 4.1 summarizes the overflows by year between 2005 and mid-2022. Note that discharges to high sensitivity receiving environments have been dramatically reduced since the Trent pump station was commissioned in late 2008. The few recent discharges to high sensitivity receiving environments were due

to massive storms (i.e., 100-year return period) or related to the construction of the treatment plant project conveyance system upgrades during storms.

Figure 4.2 summarizes the specific overflow events by year for 2016 to mid-2022 (excluding overflows from the combined sewers in the Uplands). Note that the vast majority of overflow hours occur during very large storm events when conditions are saturated.

It is expected that there will be a reduction in locations with overflows and overflow hours as a result of conveyance system upgrades related to the core area treatment plant project—fully online since early 2022.

Additionally, the Humber and Rutland pump stations overflow during most moderate-to-large rainfall events. These pump stations receive flows exclusively from the Uplands area of Oak Bay, which has fully combined sewers (one set of pipes for both sewer and stormwater). Oak Bay has an approved plan with the Province for separating the sewers in these catchments with the end goal of eliminating overflows.

Figure 4.1: Graphical Comparison of Rainfall versus Overflows

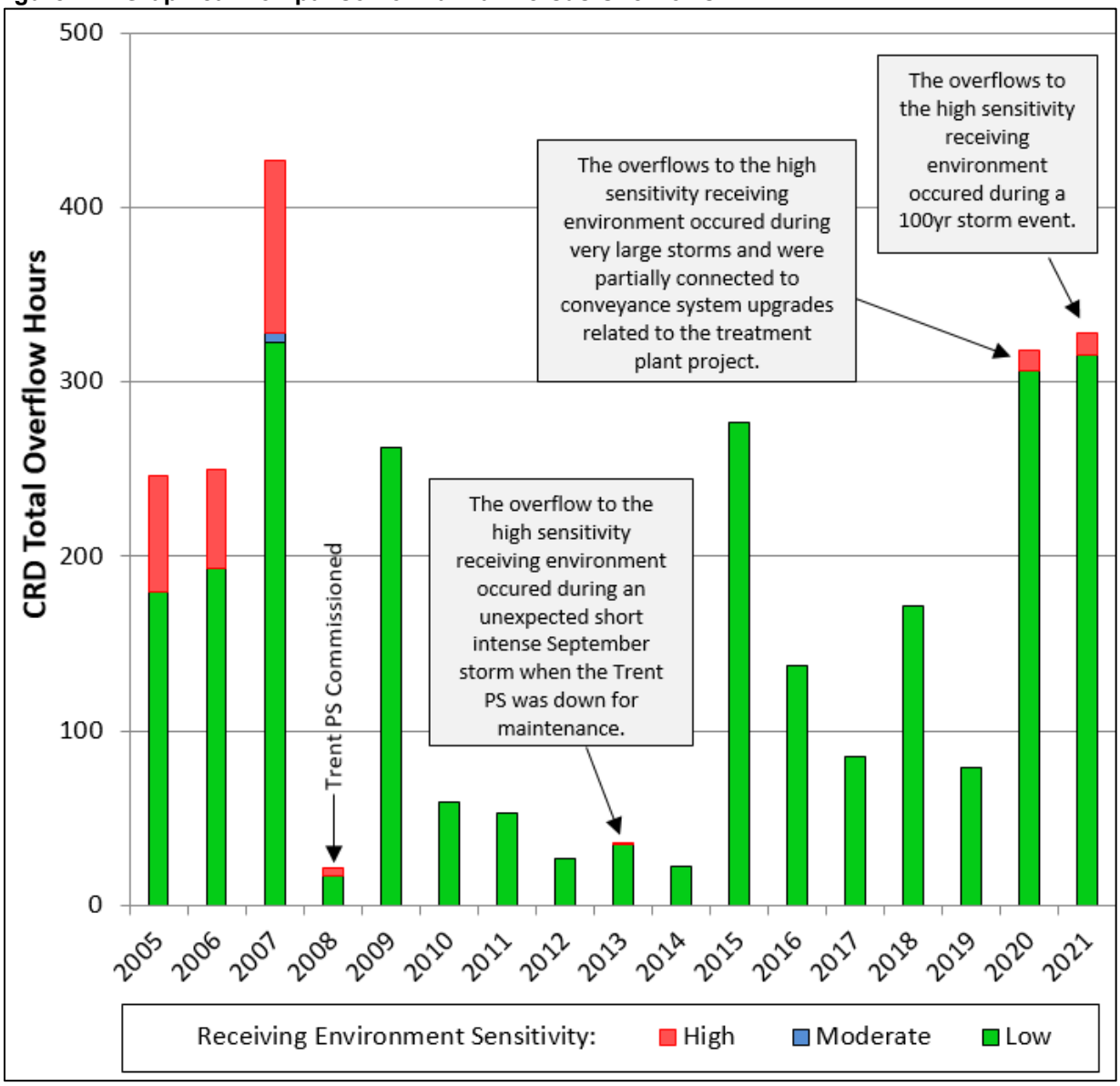
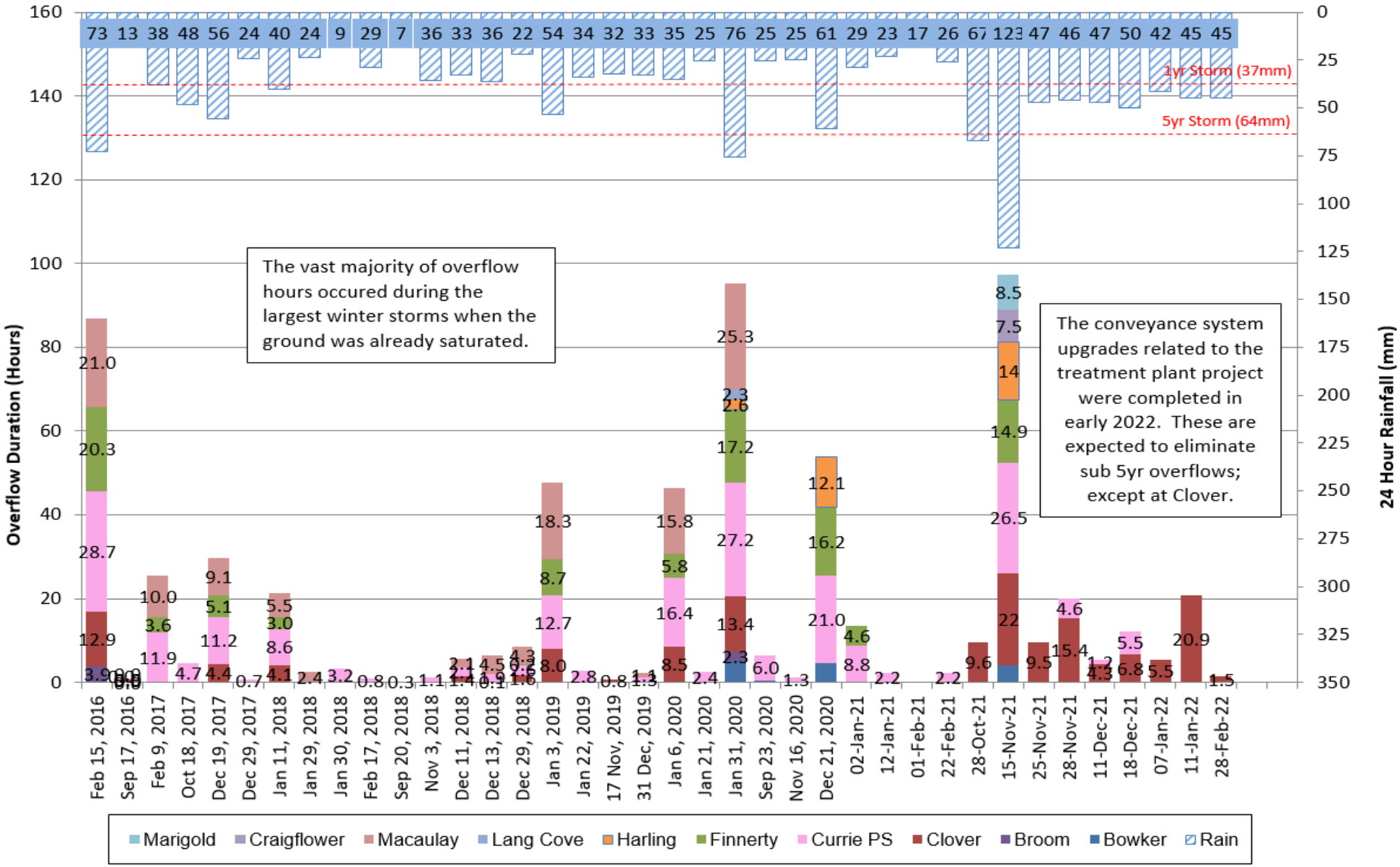


Figure 4.2: CRD Overflows from January to June 2022 (excluding the Uplands)



5. I&I RATES FOR THE CORE AREA

Regional I&I flow rates for the core area are generally analyzed every three years because there are not enough significant storm events to justify I&I analyses on an annual basis. In general, there are between 0-3 significant storm events per year. The most recent I&I results analysis was completed using data up to March 2022. The results are documented in this report.

The results of the I&I analyses are summarized as follows:

- A map of the entire core area displaying the most recent 5-year peak I&I rates for individual catchments is located in Figure 5.1.

- The individual I&I rates within each municipality have been converted into an overall weighted average for each municipality and compared with previous years' estimated I&I rates (see Table 5.1). This table is useful in providing a performance measure benchmark for each municipality to track overall I&I trends, but it must be interpreted with caution because it summarizes a vast amount of data into single municipal averages. For instance, a single very high I&I sub-area could skew the overall municipal average, or a single year of erratic weather and/or flow data could lead to misleading results. Therefore, it is prudent to allow sufficient time to measure the full effect of any I&I reduction work in addition to gathering, compiling and analyzing weather patterns and I&I rates to track overall trends.

- I&I tends to predictably increase as sewers age due to the deterioration of sewer material, types of sewer material, the environment and the installation practices of the day.

- In general, the rate of I&I tends to increase in proportion to the age of the system due to deterioration of sewer material, types of sewer material, the environment and the installation practices of the day. Older systems usually need more work than newer systems. The primary goal of the I&I program is to reduce I&I to an optimum cost-benefit level. It is expensive to size wastewater facilities to accommodate vast amounts of I&I, but it can be equally expensive to rehabilitate or replace sewers to reduce I&I. Therefore, the optimal I&I level is the most cost-effective combination of I&I reduction and I&I accommodation.

Figure 5.1: I&I Rates Map for the CRD Core Area

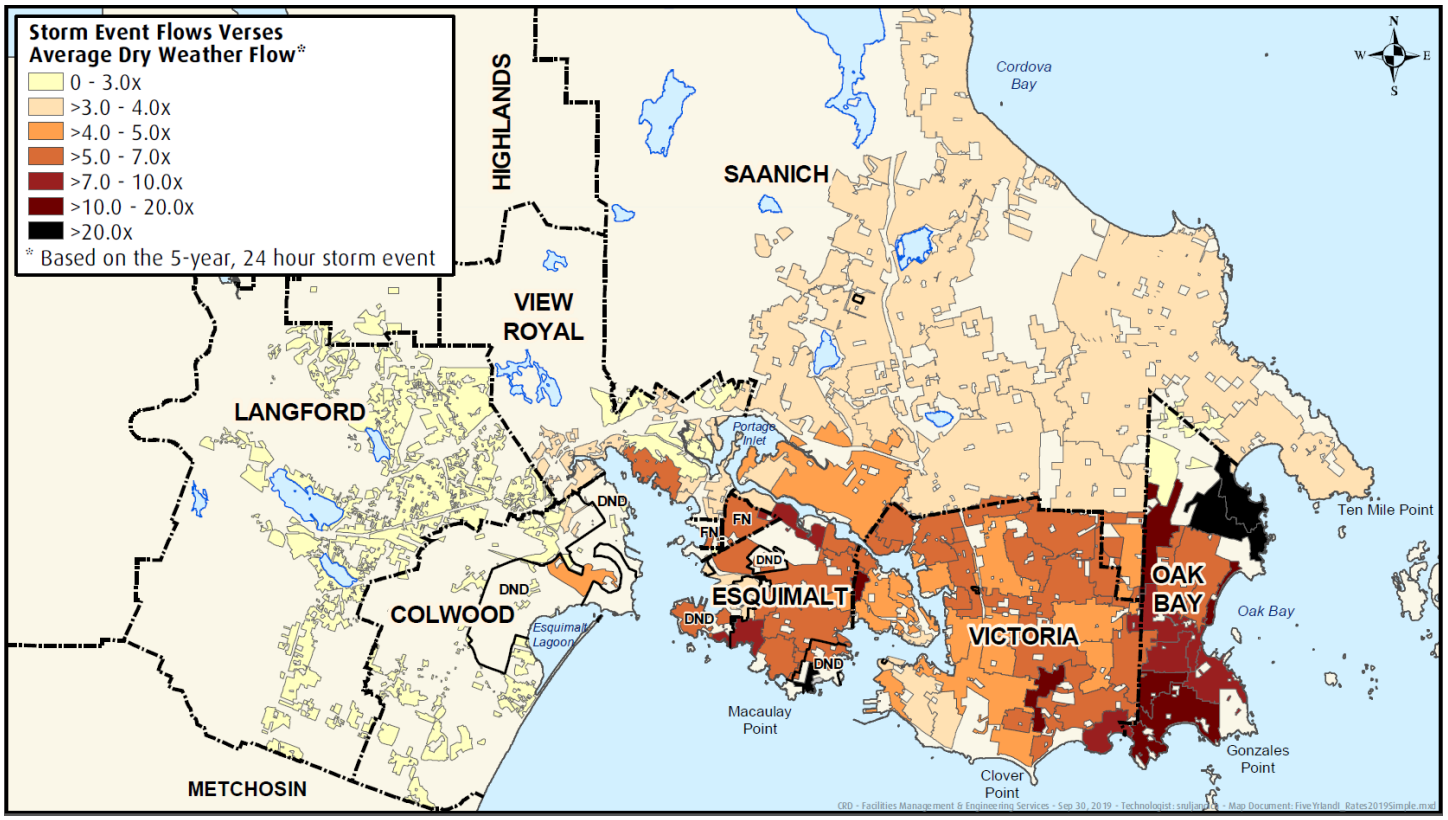


Table 5.1: Summary of CRD Core Area Municipal Peak 5-Year I&I Rates

Municipality	Ave. Age of Sewers	Estimated 5-Year I&I Rate [1] (L/ha/day)						5-Year Peak Flows [1] Compared to Average Dry Weather Flow
		2010	2012	2014	2016	2019	2022	
Colwood	20	10,309	8,540	7,965	8,777	8,777	8,777 [5]	2.3 x ADWF
Esquimalt	87	52,412	52,599	48,727	51,471	48,786	56,015	6.9 x ADWF
Langford	17	11,023	9,364	9,222	10,606	8,587	10,291	2.0 x ADWF
Oak Bay [2]	76	51,873	48,133	46,600	55,686	56,123	56,123 [3]	9.0 x ADWF
Saanich	48	15,514	13,613	15,427	15,223	14,369	15,932	3.4 x ADWF
Victoria	95	96,734	94,281	84,650	76,026	73,490	75,162	5.4 x ADWF
View Royal	35	12,322	12,294	13,216	14,525	11,541	16,037 [4]	3.5 x ADWF
First Nations	43	35,160	35,160	48,052	48,052	38,573	44,457	5.1 x ADWF

[1] Based on peak 24-hour flows. The rates are generally based on data from multiple flow meters, which are interpolated into a weighted average over each particular municipality. A 5-year storm event I&I flow rate is used, since the Municipal Sewage Regulation stipulates that a sewer system must be able to convey flow under this condition without an overflow.

[2] Excludes the combined sewer in the Uplands (which has I&I rates over 200,000 l/ha/day). Also excludes overflows from the rest of Oak Bay's sewer system because the overflow volumes aren't currently measured..

[3] Oak Bay's rate was not updated due to routine sub 5-year overflows. It's expected that these overflows will be eliminated (except in the Uplands) due to the treatment plant project conveyance system upgrades (early 2022) and that future storms will be suitable for updating Oak Bay's overall I&I rate.

[4] View Royal's increased rate is the result of changes in how the rate was calculated.

6. SEWER ALLOCATIONS

CRD Bylaw No. 4304 (2020) includes maximum allowable sewer flows for each input into the core area trunk sewer system. Each input has an allocated average dry weather flow and an allocated peak daily flow.

Table 6.1 compares measured peak 24 hour flows to the allocated flows from Bylaw No. 4304 and was prepared for information purposes only. Cells highlighted in grey note planned upgrades or known issues. Some of the known issues will be resolved now that the conveyance system upgrades related to the treatment plant project are complete (early 2022). Others are being addressed with current and planned future capital projects.

Table 6.1: Measured Flows (2022) versus Allocated Flows from Bylaw No. 4304

Allocation Point	Allocated Peak Daily Flow (ML/day)	Peak 24 Hr. Flow for a 5-yr Storm	
		ML/day	% of Allocated Capacity
COLWOOD			
Total *Parson's minus Meaford. (During large storm events, the Parson's meter is not reliable and the storm flows are calculated. The Parson's meter is being replaced in late 2022).*	**18.8**	**7.7**	**41%**
ESQUIMALT			
Esquimalt Panhandle	0.48	0.44	91%
Lang Cove PS	5.12	2.95	58%
Dockyard	4.04	3.52	87%
Kinver	1.76	2.20	125%
Pooley Place *(Flows are based on a correlation with an adjacent catchment. Catchment is not suitable for metering due to small size and multiple connections to the CRD system.)*	0.24	0.21	87%
Devonshire	7.40	10.91	147%
Wilson	1.48	1.48	100%
Head	6.72	7.82	116%
Anson	0.97	0.63	65%
Total	**28.36**	**30.16**	**106%**
LANGFORD			
Total *(Meaford)*	**56.48**	**17.01**	**30%**
OAK BAY			
Windsor	11.68	16.24	139%
Humber *(This is catchment has combined sewers. It overflows during most moderate to large storm events but the overflow volumes aren't measured.)*	2.40	4.29	177% [1]
Rutland *(This is catchment has combined sewers. It overflows during most moderate to large storm events but the overflow volumes aren't measured.)*	1.48	5.92	400% [1]
Currie Net *(Flows won't be suitable for comparing to the bylaw allocations until the treatment plant conveyance system upgrades are complete in late 2022.)*	3.88	n/a	>125%
Currie Lift Station	6.48	12.29	190%
Harling Point PS	0.79	1.86	236%
Total *(Flows won't be suitable for comparing to the bylaw allocations until the treatment plant conveyance system upgrades are complete in late 2022.)*	26.48	**n/a**	**>175%**
SAANICH			
Marigold PS	52.76	35.32	67%
City Boundary	23.52	10.97	47%
Harriet	13.08	9.37	72%
Townley	2.44	1.97	81%
Haultain	2.27	1.14	50%
Arbutus	28.31	20.95	74%
Haro - UVic	3.17	0.81	26%
Penrhyn LS	3.73	2.99	80%

Allocation Point	Allocated Peak Daily Flow (ML/day)	Peak 24 Hr. Flow for a 5-yr Storm	
		ML/day	% of Allocated Capacity
Total	**131.56**	**83.52**	**63%**
VICTORIA			
Cecelia	12.57	14.76	117%
Chapman & Gorge *(Flows are based on a correlation with an adjacent catchment. Plans are in place to install a meter)*	1.40	4.98	356%
Selkirk *(Flows are based on a correlation with an adjacent catchment. Plans are in place to install a meter)*	1.11	0.39	35%
Langford - Vic West	0.77	1.32	171%
Hereward	7.65	6.52	85%
Sea Terrace *(The flume surcharges during large storms. Because of this, the Peak 24hr flows are based on a correlation with an adjacent catchment. Options are being explored to address this issue.)*	1.32	1.50	114%
Trent Net	29.32	43.06	147%
Hollywood	2.16	7.43	344%
Olive	92.24	63.00	68%
Clover Net *(The catchment is not suitable for metering due to small size and multiple connections to the CRD system. As a result, the flows are based on a calculation.)*	6.01	7.68	128%
Total	**153.19**	**150.64**	**98%**
VIEW ROYAL			
Craigflower PS *(Flows for this catchment are substantially impacted by the Parson's mag meter, which is being replaced in 2022 to improve accuracy during storm events.)*	14.16	7.10	50%
Shoreline Trunk	0.55	0.50	91%
Total	**14.16**	**7.1**	**50%**
ESQUIMALT NATION			
Esquimalt Nation *(Flows are calculated. Plans are in place to install a meter in late 2022)*	**0.28**	**0.35**	**126%**
SONGHEES NATION			
Songhees Nation	2.36	2.49	106%
Maplebank	0.04	0.005	13%
Total	**2.52**	**3.09**	**106%**

**Cells highlighted in grey signify metering locations identified for future improvement.*

7. SUMMARY

The purpose of this report is to provide an update on work related to I&I in the core area from 2021 to mid-2022. The work supports commitments located in Section 5 of the CALWMP, which addresses the *Management of Infiltration and Inflow and Control of Wastewater Overflows.* The report included:

- summary of special projects carried out by the core area I&I program
- I&I related updates from each of the core area municipalities
- current I&I rates
- comparisons of wet weather flows to the sewer flow allocations in Bylaw No. 4304
- summary of overflow events from 2020 and mid-2021
- status of efforts to address I&I from private property

Appendix A:
Core Area LWMP Commitments Related to I&I

CAPITAL REGIONAL DISTRICT
CORE AREA LIQUID WASTE MANAGEMENT PLAN
(Consolidated Version incorporating all applicable amendments, February 2019)

SECTION 5
MANAGEMENT OF INFILTRATION AND INFLOW AND CONTROL OF WASTEWATER OVERFLOWS

GOAL

Condition 17(1)(a) of Schedule 1 of the Municipal Sewage Regulation (MSR) requires that if infiltration and inflow (I&I) causes daily flows to be greater than 2 times the average dry weather flow (ADWF), the discharger must address "how I&I can be reduced as part of a Liquid Waste Management Plan" and condition 17(2) outlines the treatment and discharge requirements for such flows.

The goal of the I&I program is therefore to comply with this requirement of the MSR by developing and implementing a strategy aimed at reducing the amount of rainwater and groundwater entering the core area's sanitary sewer system from both the publicly owned and privately owned parts of the system in order to reduce and eventually eliminate overflows from the system.

How the Capital Regional District (CRD) proposes to substantially meet the requirements of Condition 17(2) is addressed in Sections 4 and 6 and in the draft operational certificate in Section 12.

COMMITMENTS

The CRD and the participating municipalities commit to the following actions to reduce I&I sufficiently to reduce maximum daily wet weather flows to less than four times the average dry weather flow by 2030:

1. Continue flow monitoring in each municipality to further refine priority areas for remediation.

2. Develop, by the end of 2011, and submit to the Ministry of Environment, comprehensive inflow and infiltration management plans for the core area that will:
   a) Identify and evaluate options and opportunities that promote the minimization of groundwater and rainwater I&I into municipal sanitary sewer systems, including I&I originating from service laterals (private and public sections of sewer connections).
   b) Identify needed changes to legislation and legal authority to enable options and strategies.
   c) Identify opportunities for the inspection of private sewers connected to municipal sewers:
      (i) as part of the municipal process in evaluating and issuing renovation and building permits for serviced properties; and/or
      (ii) at the time of property transfer; and/or
      (iii) targeted inspections.
   d) Require the repair or replacement of private sewers that have cross-connections between storm sewers and sanitary sewer or are identified as being in poor condition.

3. Update, by the end of 2011, and enforce sewer use bylaws to prohibit the construction of rainwater and groundwater connections to sanitary sewers.

4. Implement the overflow reduction plans contained in the sanitary sewer overflow management plan, which was submitted to the Ministry of Environment in June 2008. These plans are summarized as follows:

Table 5.1
Prioritized Order of CRD Overflow Reduction Plan
(Updated based on current information)

Priority No.	O/F Name	Action Plan	Estimated Year of Completion	Estimated Cost ($2008) to Complete
1.	Monterey Avenue MH0130	Complete and commission Trent pump station	2008 (Complete)	$500,000
2.	Macaulay Point Pump Station	Complete installation of standby power	2008 (Complete)	$800,000
3.	Harling Pump Station	Install a screen on the overflow pipe	2008 (Complete)	$10,000
4.	Shoreline Drive MH0340	Commence with capacity deficiency study and identify upgrade options	2010	$50,000
5.	Penrhyn Lift Station	Investigate pump and genset capacity	2010	$600,000
6.	Humber Combined Sewers	Oak Bay plans to separate the sewers in the Uplands area	2015	To be determined (Oak Bay cost)
7.	Rutland Combined Sewers	Oak Bay plans to separate the sewers in the Uplands area	2015	To be determined (Oak Bay cost)
8.	Head Street MH0040	Twin the NWT from Macaulay Point to MH0055	2015	$20,000,000
9.	Sea Terrace MH0055	Twin the NWT from Macaulay Point to MH0055	2015	as above
10.	Broom Road	Extend Trent forcemain down to Clover Point	2017	as above

Table 5.2
Prioritized Order of Colwood Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost ($2008) to Complete
1.	SCADA Upgrade	Upgrade the SCADA system to collect flow data from all pump stations.	2008 (Complete)	$10,000
2.	CCTV Inspection	Continue to inspect all new sewers that are installed to ensure they are well constructed	Annually	$15,000
3.	Sewer System Maintenance	Continue to clean all mains and manholes, and repair as necessary.	Annually	$50,000
4.	Lift Station Maintenance	Continue to maintain all lift station components to ensure that they run efficiently.	Annually	$72,500

Table 5.3
Prioritized Order of Esquimalt Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost ($2008) to Complete
1.	Sewer Relining	Relining and repairs to sewer mains rated poor and poorest	Completed	n/a
2.	Combination Manhole Separation	• 148 manholes remain to be separated • 29 manholes to be separated in 2008 • Five manholes separated per year from 2009 to 2025	2025	$950,000
3.	Grafton Pump Station Upgrade	New electrical power supply, kiosk and controls	2008 (Complete)	$38,000
4.	Grafton Pump Station Upgrade	Pump replacement	2012	$40,000
5.	Sewer Main Replacement	Replacement of undersize sewer main on Craigflower Road between Tillicum Road and Lampson Street	2009 (Complete)	$250,000
6.	Municipal Wide Smoke and Dye Testing	Smoke and dye testing underway to identify cross connections in attempts to reduce I&I in the future. The full scope of the project has not yet been determined.	2010	unknown

Table 5.4
Prioritized Order of Langford Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost ($2008) to Complete
1.	Sewer Master Plan Upgrades	Continue with infrastructure upgrades as identified in the Sewer Master Plan.	Ongoing	$0.2-0.5 Million
2.	CCTV Inspection	Continue to video inspect all new sewers that are installed to ensure that they are well constructed.	Annually	$15,000
3.	Manhole Inspection	Continue to visually inspect manholes to ensure that they do not leak.	Annually	$15,000
4.	Pump Station Maintenance	Continue to maintain all pump station components to ensure that they run efficiently.	Annually	$200,000
5.	Sewer System Maintenance	Continue to keep the sewers clean and free from defects.	Annually	$25,000

Table 5.5
Prioritized Order of Oak Bay Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost ($2008) to Complete
1a.	Uplands Sewer Separation Humber Catchment	Construction of new storm sewer	To be confirmed by December 31/2019	$5,285,000
1b.	Uplands Sewer Separation Rutland Catchment	Construction of new storm sewer	To be confirmed by December 31/2019	$9,815,000
1c.	Uplands sanitary sewer pipeline rehabilitation	Rehabilitation of the former combined sewer pipeline to address infiltration	To be confirmed by December 31/2019	$3,000,000
2.	Oak Bay Inflow and Infiltration Rehabilitation Project	Continue with phased rehabilitation projects in various catchments	Annually	$500,000
3.	CCTV Inspection	Video inspection of sewer mains	Annually	$25,000
4.	Sewer System Maintenance Program	Maintenance to keep sewers clean and free from defects.	Annually	$240,000

Table 5.6
Prioritized Order of Saanich Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost ($2008) to Complete
1.	Dysart Pump Station	Complete construction of the new Dysart pump station.	2008 (Complete)	$2,500,000 (est.)
2.	The following pump stations will be upgraded: Vantreight Lift Station Murray #1 Pump Station Murray #2 Pump Station Arundel Pump Station Glenwood Pump Station Ashley Pump Station Dunkirk Pump Station Colquitz Pump Station Gorge Pump Station	Rebuild pump station and add a new standby generator.	2009-2015	$500,000 Annually

Table 5.7
Prioritized Order of Victoria Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost ($2008) to Complete
1.	James Bay I&I Pilot Project	Commence with the rehabilitation of sewer mains, laterals and manholes in James Bay.	2010	$3,000,000
2.	Hydraulic Model	Continue to complete a hydraulic model of the City's entire sanitary sewer collection system.	2009	$100,000
3.	Overflow Elimination	Investigate, monitor and abandon, if possible, existing known overflow locations.	2010	$100,000
4.	Combined Manhole Separation	Investigate, monitor and initiate a program to separate combined manholes.	2015	$400,000

Table 5.8
Prioritized Order of View Royal Overflow Reduction Plan

Item No.	Work Name	Description	Estimated Year of Completion	Estimated Cost ($2008) to Complete
1.	Upgrade Pump Stations	Upgrade pump stations where required to improve pump performance, provide standby power and collect better data.	2017	$140,000
2.	CCTV Inspection	Continue to video inspect all new sewers that are installed to ensure that they are well constructed.	Annually	$20,000
3.	Manhole Inspection	Continue to visually inspect manholes to ensure that they do not leak.	Annually	$5,000
4.	Pump Station Maintenance	Continue to maintain all pump station components to ensure that they run efficiently.	Annually	$120,000
5.	Sewer System Maintenance	Continue to keep the sewers clean and free from defects.	Annually	$40,000

APPENDIX C

Excerpt from the Capital Regional District Core Area Liquid Waste Management Plan – Sanitary Sewer Overflow Management Plan, June 2008.

Appendix B:

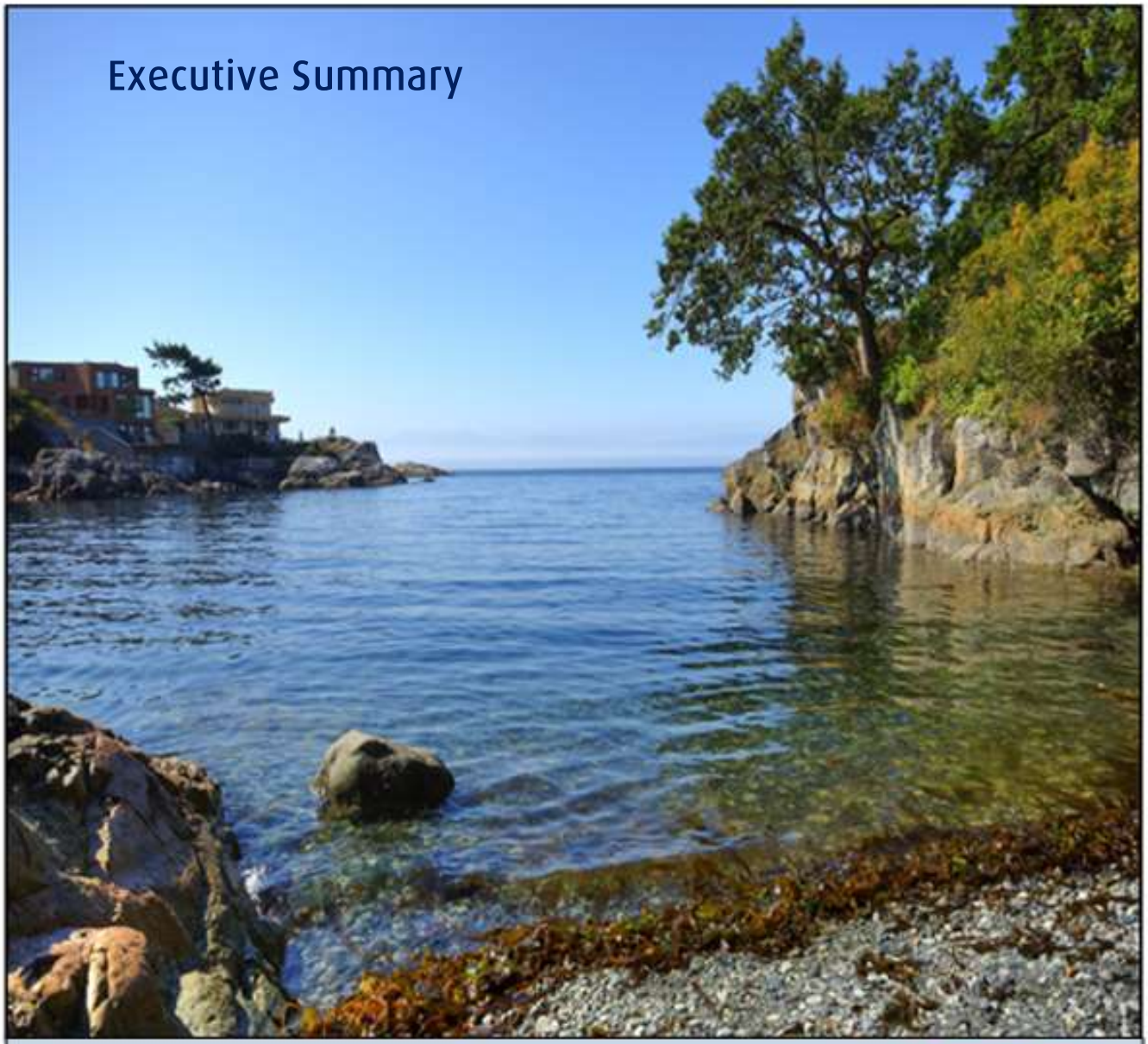
EXCEUTIVE SUMMARY: CORE AREA I&I MANAGEMENT PLAN: 2017 UPDATE

Capital Regional District

Core Area Inflow & Infiltration Management Plan

2017 Update

Executive Summary



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CORE AREA INFLOW & INFILTRATION MANAGEMENT PLAN

EXECUTIVE SUMMARY

Purpose

The purpose of the plan is to guide the Capital Regional District (CRD) and its municipal partners towards Inflow and Infiltration (I&I) reduction in a responsible, cost effective, integrated and well-planned manner. The primary objective of the plan is to reduce overflows and I&I to less than four times average dry weather flow (4xADWF), based on a five year return period, at Clover Point and the Core Area Wastewater Treatment Plant at McLoughlin Point by 2031.

Background

The core area municipalities are actively managing inflow and infiltration (I&I), a term that describes rainwater and groundwater that mistakenly gets into the sanitary sewer system. Inflow refers to rainwater that enters the sewer through plumbing cross connections and infiltration refers to groundwater that seeps into the sewer through cracks, faulty joints, etc. A certain amount of I&I is unavoidable and is accounted for in routine sewer design. However, too much I&I results in excessive sewer flows which can lead to:

- leaking sewers and overflows that can contaminate the environment and create public health concerns;
- backing up of sewage into buildings and homes that can destroy belongings and require expensive restoration;
- increasing operation and maintenance costs to convey and treat the increased flows; and
- consuming sewer capacity which could require expensive premature upgrades to the system.

The content of the Core Area I&I Management Plan is organized in the following sections: 1) Overview; 2) Overflows; 3) Asset Management; 4) Climate Change; 5) Public Property I&I; 6) Private Property I&I; 7 to 17) Municipal Plans; and 18) Monitoring & Verification.

Regulatory Context

The core area wastewater system is governed by the Core Area Liquid Waste Management Plan (LWMP). This plan was first approved by the Ministry of Environment in 2003. Since that time, there have been a number of amendments to the plan, the most recent being Amendment No. 11 (approved in 2016).

Section 5 of the plan relates to I&I and overflows and includes the following commitments:

> *The CRD and the participating municipalities commit to the following actions to reduce I&I sufficiently to reduce maximum daily wet weather flows to less than four times the average dry weather flow by 2030:*
>
> 1. *Continue flow monitoring in each municipality to further refine priority areas for remediation.*
>
> 2. *Develop, by the end of 2011, and submit to the Ministry of Environment, comprehensive inflow and infiltration management plans for the core area that will:*
>   - *Identify and evaluate options and opportunities that promote the minimization of groundwater and rainwater I&I into municipal sanitary sewers, including I&I originating from service laterals (private and public sections of sewer connections)*
>   - *Identify needed changes to legislation and legal authority to enable options and strategies*
>   - *Identify opportunities for the inspection of private sewers connected to municipal sewers:*
>   i. *as part of the municipal process in evaluating and issuing renovation and building permits for serviced properties; and/or*

ii. *at the time of property transfer, and/or*
iii. *targeted inspections*

- *Require the repair or replacement of private sewers that have cross-connections between storm sewers and sanitary sewers or are identified as being in poor condition.*

3. *Update by the end of 2011, and enforce sewer use bylaws to prohibit the construction of rainwater and groundwater connections to sanitary sewers.*

4. *Implement the overflow reduction plans contained in the sanitary sewer overflow management plan, which was submitted to the Ministry of Environment in June 2008.*

Overflows

In 2014, the CRD submitted an updated core area overflow management plan to the Province. The plan documents the CRD's overflow related commitments and summarizes the significant work carried out related to overflows.

Asset Management

Asset management programs for sewer collection systems generally focus on the planned replacement of infrastructure based on remaining service life. Municipalities need to demonstrate that they are following the Asset Management BC Framework to qualify for federal gas tax funding.

Climate Change

Over the next five years, the CRD will carry out actions supporting a vulnerability assessment of CRD sewer infrastructure due to climate change. The actions include updating the core area sewer model, running the sewer model using climate change scenarios, and providing recommendations based on the results.

Public Property Inflow and Infiltration

I&I and overflow quantification helps municipalities to understand the condition and/or performance of their sewer systems. Quantified measurements can be compared to benchmarking standards and allow municipalities to track I&I performance. The most useful quantification methods are repeatable and follow a standardized approach. Examples of I&I quantification methods proposed in this plan include: statistical analysis of sewer flow data to calculate I&I rates, quantifying overflows based on given storm events, ranking structural integrity of sewer pipes based on closed circuit television (CCTV) inspections, counting cross-connections through smoke testing, documenting manhole condition and calibrating system performance using hydraulic models.

The public property I&I reduction plans are consistent with the systematic approach noted in the Infraguide for "Infiltration/Inflow Control/Reduction for Wastewater Collection Systems". Infraguide was a partnership between the Federation of Canadian Municipalities, the National Resource Council and Infrastructure Canada. It created best practice reports for municipal infrastructure. The guide proposes that I&I reduction programs be divided into the following three phases:

- Phase 1 - involves flow monitoring and data collection. The data is used to identify catchments that should be targeted for sewer investigation work.
- Phase 2 - involves sewer investigation work to identify specific sources of I&I. The data is used to create rehabilitation plans and to prioritize I&I rehabilitation work.
- Phase 3 - involves sewer rehabilitation work. The rehabilitation work is based on investigation data from Phase 2. If investigation data is not yet available, then archetype I&I rehabilitation programs should be used.

Archetype I&I rehabilitation programs were developed to provide a framework under which any given sewer catchment can be evaluated and related to an actionable plan to move forward with I&I assessments and

sewer rehabilitation. These programs are to be used as planning tools. They should be interpreted from a strategic planning level and are suitable for establishing long-range budgets and for steering the development of targeted I&I reduction programs.

Private Property Inflow and Infiltration

The I&I Management Plan (2012) contained a five-year plan for implementing a common private property I&I approach for the core area. The plan was to consult with stakeholders and the public from 2012 to 2014, recommend an approach in 2015 and implement that approach in 2016. Significant effort was made to come up with a common approach. By 2014, it was clear that a common approach wasn't appropriate as the core area municipalities have different I&I rates, different issues and require different solutions. Three of the core area municipalities have older sewers and elevated I&I and they would benefit from strong programs to reduce I&I. The other four municipalities have newer sewers and have low I&I. These municipalities would prefer to focus on I&I prevention activities. The I&I Subcommittee agreed that each municipality should implement their own custom approach to suit their needs and should draw on the significant research and support that the CRD has provided.

In late 2014, the CRD Board directed that a sample model bylaw related to the inspection of private sewer laterals connected to municipal sewers be prepared. The sample bylaw was built using past I&I Subcommittee feedback and content from the Pinna Report (2014) which documented the best I&I related language from existing Canadian and American bylaws. It underwent legal review and I&I Subcommittee review for general acceptability. The sample model bylaw was presented to the Core Area Liquid Waste Management Committee on May 13, 2015. The Core Area Liquid Waste Management Committee recommended that the sample bylaw be discussed with the I&I Subcommittee to determine how best to move it forward. The I&I Subcommittee decided that it would be best to incorporate the powers from the sample model bylaw into the existing municipal sewer use bylaws. Subsequently, a gap analysis was carried out comparing the powers from existing municipal sewer bylaws to the draft sample model bylaw and presented to the member municipalities through the I&I Subcommittee.

The next steps for addressing private property I&I include:

- assisting municipalities with the further development of private property I&I reduction plans;
- supporting the implementation of the powers from the sample model bylaw for private property I&I into existing or new municipal sewer bylaws;
- developing common public education materials for use by key industry stakeholders (i.e. plumbers, realtors and home owners);
- updating the general education approach to focus on homeowner protection (i.e. basement flooding) and environmental protection and how I&I plays an integral role; and
- continued collaboration with Metro Vancouver and the National Water and Wastewater Benchmarking Initiative's I&I Task Force.

Municipal Inflow and Infiltration Plans

Each of the core area municipalities has participated in the development of their own individual municipal I&I plans. The municipal plans are organized into eight sections:

1. *Overview*
2. *Catchments* - A list and map of the long-term flow monitoring catchments that will form the basis for evaluation of I&I rates and I&I management planning
3. *Inflow & Infiltration Data* – Summary of historical data collected, current data collected, summary of I&I analyses results, and flow data analyses
4. *Sewer Infrastructure Maintenance & Capital Work* – summary of routine sewer work, notable work completed between 2012 and 2015, and notable work planned for 2016 to 2020
5. *Asset Management* – high level municipal tools, approaches, etc.
6. *Bylaws* – Contains a comparison of the key powers suggested by the CRD Private Property I&I Model Bylaw to those found in each of the municipality's existing sewer bylaws

7. *Budget* – Summary I&I budget related information
8. *Summary* - A high level summary and a graph showing projected peak wet-weather flow (PWWF) relative to 4xADWF for the entire municipality from 2011 to 2031

Monitoring and Verification

Monitoring and verification of I&I Management Plan objectives will be achieved by using the following metrics:

1. Comparison of peak wet weather flow (PWWF) with 4xADWF at Clover Point and the proposed wastewater treatment plant. This will include graphs comparing projected PWWF and ADWF verses actual rates recorded over time.
2. Flow monitoring of all catchments to track I&I rates paying extra attention to measuring flows before and after targeted I&I reduction work to verify results.
3. Tracking overflows by location, frequency, duration and receiving environment sensitivity rating to monitor trends and verify results.
4. Completion of detailed and specific I&I management strategies for each catchment to replace the archetype plans.
5. Reporting of efforts and costs applied towards I&I management on a regular basis.

The CRD will continue to provide annual reports on the I&I program to the Core Area Liquid Waste Management Committee. Every second year the I&I analyses results will be updated, as is the current practice, and an I&I benchmarking template will be filled out for each of the core municipalities. The benchmarking template is currently in development and will include a number of performance measure criteria to help gauge the level of effort each municipality is applying to I&I management.

Forecasted Inflow and Infiltration Reduction

Additional work will be needed to meet the LWMP commitment of reducing wet weather flows below 4xADWF at Clover Point and the McLoughlin Point Treatment Plant by 2031. However, the gap between 4xADWF and peak wet-weather flow (PWWF) is decreasing, which is significant as it takes a substantial investment of time and resources to reverse the natural trend of I&I increasing with sewer age.

Colwood, Langford, Saanich and View Royal already meet the 4xADWF performance target. This is largely due to having young sewers built with modern materials and good installation practices. These municipalities will need to focus on I&I prevention in order to continue to meet the performance target.

Esquimalt, Oak Bay, and Victoria have older sewers which tend to have elevated I&I rates. If we extrapolate out current I&I rates, it is evident that these municipalities will need to focus on I&I reduction to meet their commitments not to exceed the 4xADWF performance target. This will require increased focus and funding on I&I reduction to achieve their reduction targets. Financial support (i.e. grants) from senior government would help to accelerate the I&I reductions. It is worth noting that:

- Esquimalt rehabilitated all of its sewers and manholes that required structural repairs in the early 2000's. It has also separated almost all of its combined manholes. Esquimalt's next steps for addressing I&I will involve actions related to I&I from sewer laterals and stormwater sewer upgrades.
- Oak Bay's I&I reduction work focused on developing a plan for the separation of the combined sewers in the Uplands area. Oak Bay finalized the separation plan in 2017. This was Oak Bay's highest I&I related priority and was required as part of a LWMP commitment. Oak Bay also completed the significant task of collecting sewer flow data for each of its outstanding catchments using portable meters. Oak Bay's next steps for I&I reduction will be to implement the Uplands' separation project, to complete the collection of sewer camera inspection data for the municipality and to update its sewer master plan based on the results of the camera inspections.
- Victoria has collected sewer flow data for its outstanding catchments, and has also performed camera inspections and smoke testing throughout the entire municipality. The data will be analyzed and actions put into Victoria's sewer master plan. Updating a sewer master plan is a substantial project. Victoria

had to delay the update of its sewer master plan until the location of the core area treatment plant was finalized because some of the locations considered for the plant would have resulted in dramatic changes to the plan. Work on the sewer master plan commenced in late 2016 after the regional treatment plant location was finalized.

The CRD is committed to assisting individual municipalities in the development of suitable private property I&I initiatives. Such initiatives could accelerate a municipality towards meeting its performance targets as it is estimated that 50% of I&I enters the sewer system on private property. Currently, there are no significant private property I&I initiatives in the core area; however, the research needed to develop such commitments is complete.

In addition, it is anticipated that significant progress will be made through the continuation and further development of I&I related education, stakeholder engagement, regulatory mechanisms, permit requirements, time of home sale options and through targeted pilot programs.

Key Future Actions

The next steps for addressing private property I&I include:

- supporting the implementation of the powers from the sample model bylaw for private property I&I into existing sewer municipal bylaws or into a new bylaw;
- assisting municipalities with the development and implementation of municipality specific private property I&I reduction plans;
- developing common public education materials for use by key industry stakeholders (i.e. plumbers, realtors and home owners);
- updating the general education approach to focus on homeowner protection (i.e. basement flooding) and environmental protection and how I&I plays an integral role; and
- continued collaboration with Metro Vancouver and the National Water and Wastewater Benchmarking Initiative's I&I Task Force.

The next steps for addressing public property I&I include:

- identifying "semi-combined" sewers in the core area and developing plans to address them;
- taking leadership on I&I benchmarking and taking action to introduce nationally;
- updating the core area sewer model, running the sewer model using climate change scenarios, and providing recommendations based on the results; and
- ongoing I&I metering, analyses and program development.

Conclusion

The Ministry of Environment reviewed and approved Amendment No. 11 of the Core Area LWMP. The LWMP included four commitments related to I&I and overflow management which are fulfilled by the I&I Management Plan.

The plan is purposeful and guided by a number of federal, provincial, regional and municipal regulatory documents and best practices. It provides the framework for how I&I can be quantified and establishes priority programs and approaches for each municipality and the CRD to follow. A strategy has been developed for moving the issue of private property I&I forward and the whole program will be monitored, verified and reported out using standard metrics and templates.

All core area municipalities assisted in the preparation of the plan and the specific actions and programs were developed based on current CRD and municipal funding levels for I&I and sewer service budgets. Modelling the results of implementing this plan show that the goal of reducing I&I to 4xADWF at Clover Point and the wastewater treatment plant is achievable but will require additional effort.

Appendix C:

PRIVATE PROPERTY I&I WORK PRIOR TO 2021

Summary of Private Property I&I Actions to Date in the CRD

Timeline	Action
Ongoing	• CRD: - review case studies of jurisdictions taking steps to deal with private property I&I - meet with various experts and share information - work with and share information with Metro Vancouver, which is also working to establish programs to address private property I&I - are members of the National Water and Wastewater Benchmarking Initiatives I&I Task Force - provide I&I education to the public • Two municipalities within the core area (Oak Bay and Esquimalt) require that laterals be inspected and fixed if required, when applications are made for major building permits. • Each of the core area municipalities have sewer bylaws or council policies that relate to private property I&I. • The CRD is working with other jurisdictions regarding private property I&I approaches. For example, the CRD shares information and routinely interacts with Metro Vancouver. The CRD is also part of the National Water and Waste Water Benchmarking Initiatives I&I Task Force, whose members come from municipal engineering departments from across Canada including: Vancouver, Calgary, Regina, Toronto, and Halifax. The CRD has an active role on the I&I task force and has made presentations regarding private property I&I and has shared I&I video's and educational graphics.
2020 to mid-2022	Commissioned a report summarizing downspout disconnection programs and best practices from around Canada. In summary, many parts of Canada allow downspouts to be disconnected so that their flows discharge to the ground away from buildings. Even the insurance industry has documents showing when this can be appropriate. The purpose of this project was to summarize how and when this is currently done in Canada. Included are a number of municipal examples. The results will be used to see if downspout disconnections could be a tool for addressing roof drains found to be cross-connected to the sanitary sewer.
2019 to 2020	The CRD has developed the following items to support the updated I&I education approach: • a brochure and banner that fully aligns with the Generally Accepted Principles document, • updated website content to align with the new approach, • attendance at a list of key regional events to interface with the public, including annual home show events, municipal events and key stakeholder events, and • a slideshow for presenting to realtors.

Timeline	Action
2018 to 2019	The educational approach for addressing private property I&I was updated. The approach has the same desired outcomes as the existing approach: to promote the inspection and maintenance of sewer laterals. However, the approach focuses on preventing basement flooding which is more relevant to homeowners. The central document for the approach is the "Generally Accepted Principles" document, which: • has full acceptance from the key stakeholder groups, • aligns the various stakeholder groups on the topic, • is designed to answer questions that the public may have on the issue in a clearly communicated fashion, • establishes relationships with the various I&I related stakeholders, • was developed in partnership with over 20 key stakeholder groups (local, provincial and national). Through consensus, the focus was extended to all private property underground pipes, including foundation drains and stormwater laterals, and • can be used by stakeholder to educate the public. In late 2018, the CRD completed a report documenting how each of the key stakeholder groups preferred to be engaged on the I&I topic. The report also documented the level of outreach effort deemed appropriate for each of these groups.
2017	The following is a list of private property I&I work carried out in 2017 and the first half of 2018, details of which are located in Section 2: • completed a background report to better understand I&I-related stakeholders, • a report showing how to identify semi-combined sewers using GIS, • collected additional private property I&I models bylaws from across Canada, and • Enforcement Approach for Addressing Cross Connections, as presented by the City of Burnaby to the Core Area I&I Subcommittee.
2016	• In general, the I&I Subcommittee agreed that the powers from the sample model bylaw should be incorporated into existing municipal sewer bylaws. To support this, the CRD retained consultants, Pinna Sustainability Inc., to compare the powers in the sample model bylaw to the powers in each municipality's existing sewer bylaws, and a gap analysis was completed. Based on the results, recommendations were made for updating each of the municipal sewer bylaws using language from the sample model bylaw. One municipality noted that they may include parts of the sample model bylaw as part of a new municipal bylaw. • On February 11, 2016 the CRD presented to the National Water and Wastewater Benchmarking Initiatives I&I Task Force on the topic of "Implementation of a Private Property I&I Management Program". The CRD is considered a frontrunner in Canadian municipalities regarding private property I&I efforts, and staff shared the CRD's experiences and plans for moving forward.

Timeline	Action
2015	• In late 2014, the Core Area Liquid Waste Management Committee (CALWMC) asked the CRD to prepare a sample model bylaw related to private property I&I. The sample bylaw was built using past I&I Subcommittee feedback and the best parts of existing bylaws from across Canada and the US, as documented in the report by Pinna Sustainability Inc. in 2014. The draft bylaw was reviewed by a lawyer and by the I&I Subcommittee for general acceptability. The sample model bylaw was prepared and presented to the CALWMC on May 13, 2015. The committee recommended the sample bylaw be discussed with the I&I Subcommittee to determine how best to move it forward. The I&I Subcommittee decided it would be best to incorporate the powers from the sample model bylaw into the existing municipal sewer use bylaws. One municipality (Esquimalt) may customize the sample model bylaw into a stand-alone bylaw suitable for Esquimalt.
2014	• On May 22, 2014, the I&I Subcommittee unanimously recommended that each municipality be able to customize their approach for meeting agreed-upon targets. This could involve a model bylaw that could be altered, as required, to meet the needs of individual municipalities. Overall, it was understood that municipalities with elevated I&I need a different approach than municipalities with low I&I. • In 2014, the CRD commissioned a study by Pinna Sustainability Inc. to prepare a memo entitled Update on Private Property I&I Programs. (Staff from Pinna wrote the original "Stantec" report in 2010.) It contains supplementary research for the Stantec Report (2010). Notably it: - summarizes effective "drivers" for private property I&I programs, - details private property I&I programs from across Canada by province, - contains updates on private property I&I programs from the US, - documents potential problems related to implementing private property I&I programs and includes North American examples, and - summarizes "good practices" that should apply to all private property I&I programs. For each "good practice" there is example bylaw language taken from existing Canadian sewer bylaws. • In late 2014, the CALWMC asked the I&I program staff to make a presentation to it in early 2015 and to include a working "draft" model bylaw in the presentation.
2013	• Staff shortlisted private property I&I options and refined the options. • The I&I Subcommittee reviewed the shortlist and provided feedback on multiple occasions. • Options were discussed with representatives from stakeholder groups (i.e., real estate, building association, building inspection and insurance industry, etc.)
2012	• Staff prepared private property I&I specific education materials related to the program options noted in the Stantec report, including: - handouts summarizing each of the program option categories, - a detailed comparison table of the options, and - a reference guide covering frequently asked questions. • In June 2012, CRD staff hosted a workshop focused on private property I&I for elected representatives. The purpose of the meeting was to present background information, options for moving forward, and to open dialogue on the topic. New ideas were discussed and those who were present endorsed the implementation of the consultation portion of the private property I&I plan.

Timeline	Action
	• On November 30, 2012, CRD staff put on a workshop for members of the Victoria Real Estate Board. The workshop was a collaborative effort between the Core Area I&I Program, Onsite Program (i.e., septic systems) and Cross Connection Program. The purpose of the workshop was to provide education and to promote the use of infrastructure inspection in the real estate industry.
2011	• CRD staff provided an overview of the 2010 Stantec report to elected representatives and recommended a full workshop in 2012. • CRD staff initiated an I&I-related educational program that included new educational materials and education outreach events including: an I&I brochure for residents, a comprehensive website, a survey used in 2012 to 2014, and educational videos. Public education regarding I&I will now be ongoing.

2010	• CRD staff commissioned a report, completed by Stantec Inc., showing potential management options for addressing private property I&I. The report included a summary of private property I&I programs used throughout North America, costs/effectiveness of these programs, and legal options for implementing programs in the region. The programs were generally a hybrid of one or more of the following categories:
	
	1. Education-based approaches:
	  • Brochures and websites
	  • Sewer lateral certificate programs
	  • Real estate disclosure forms
	2. Incentive-based approaches:
	  • Grants or rebates for inspection, repair or replacement
	  • Deferred payment program (low or no-interest loan)
	  • Property tax exemption
	3. Enforcement-based approaches:
	  • Time of sale requirement to obtain a sewer lateral certificate before transfer of title
	  • Fines on monthly utility bills for non-compliance
	  • Termination of water or sewer service for non-compliance
	4. Targeted inspection approaches:
	  • Agency identifies problem connections through investigation work (i.e. smoke testing)
	  • Agency may fund and/or undertake work to repair identified problems (i.e. with tax money)
	  • Alternatively, agency may employ incentive or enforcement mechanisms to have property owners repair identified problems (home owner pays potentially with municipal incentive.)
	
	• A workshop was held with municipal and regional staff to initiate discussion about options for implementing private property I&I programs, objectives, and potential barriers. It was agreed that the key objectives for a private property I&I program would be to: protect the environment, create system capacity, minimize costs, increase ownership responsibility and awareness, and minimize liability issues. A summary of this workshop is located in the Stantec report.

APPENDIX D

I&I EDUCATION WORK PRIOR TO 2021

Summary of CRD I&I Education Efforts to Date

Action	Description / Timeline
2020 to 2022	Private Property I&I: As a result of COVID-19, a number of planned education actions had to be put on hold. Efforts will resume in late 2022. Public Property I&I: IWS and the I&I program continue to produce monthly sewer use reports for each of the core area municipalities and First Nations.
2019 and 2020	**Private Property I&I** On January 23, the CRD had a booth at the 2020 Vision Victoria Real Estate Board conference and debuted the new I&I education approach to key stakeholders. The reception to the approach was exceptional. Of key significance: • Many realtors visited the booth and were interested in both the brochures and the detailed GAP document. In general, they noted that the materials were both useful and relevant to them. • Five realtor offices invited the CRD to present at their "Lunch n Learns" or "Coffee Talks", which realtor offices typically have each month. It is believed that the CRD could schedule similar talks for most real estate offices in the region as they are always looking for relevant content for these talks. • Tony Joe, local radio personality, invited the CRD to have an extended interview related to the I&I education approach on "The Whole Home Show with Tony Joe", a radio show on CFAX 1070 that focusses on real estate issues. It is a great sign that Tony Joe sees the value in the updated education approach because not only is he a realtor, he is a past president of the Victoria Real Estate Board and an Instructor for the British Columbia Real Estate Association. As a result of COVID-19, a number of planned education actions had to be put on hold. To move things forward, efforts will be made to target the key stakeholder groups (i.e. plumbers, home inspectors, realtors) potentially through targeted video's, webinars, etc.
	Public Property I&I IWS and the core area I&I program worked together to develop monthly wastewater flow reports for the core area municipalities and First Nations.
2018 and 2019	Developed an updated education approach making it more relevant to home owners and related stakeholders, as summarized in Section 2.2. The rollout of the updated approach was initiated in the fourth quarter of 2019.

2011 to Present	I&I was added to CRD outreach events where I&I materials were displayed along with those other CRD programs. In general, I&I was “featured” at four key events (e.g. home shows) per year and the materials made available upon request at an additional 10 events. From talking to CRD outreach staff, attending outreach events and talking to stakeholder groups, it is clear that I&I knowledge is low with the general public. Most people have little interest in the topic and say that they will deal with issues if they come up.
2010	The CRD I&I program, in collaboration with the core area municipalities, created a brochure, two sets of videos to help explain I&I, and developed an I&I website. This information is valuable when staff are providing notification to neighborhoods of upcoming video inspection, smoke testing, sewer rehabilitation or other work related to I&I management. The overall approach was consistent with other municipalities around North America.

APPENDIX E

REPORT DOCUMENTING PRIVATE PROPERTY I&I PROGRAMS FROM ACROSS NORTH AMERICA

2022 Update on Private Property I&I Programs

Supplementary research for the 2014 report entitled Private Property Inflow & Infiltration (I&I) Management Options for the ***CRD Core Area***

April 2022

Pinna Sustainability

Memo Contents

1 Scope and Purpose of this Memo

This report is an update to two previous reports commissioned by the Capital Regional District to identify Private Property Inflow & Infiltration (I&I) Management Options for the CRD Core Area ("2014 Report" & "2011 Report"). The 2011 Report included a review of the approaches employed by other jurisdictions in the management of private property I&I (PPI&I), and a review of the legal authority and considerations for adopting these approaches in the CRD context. Then, the 2014 Report highlighted a number of municipalities across Canada and the US that have continued to address private property I&I through various means. This memo serves to supplement the 2014 Report by providing an update that summarizes:

- The key drivers for municipalities that have implemented private property I&I programs.
- Of the programs originally reviewed, the programs that are most relevant to the CRD context, and their key drivers.
- The state of private property I&I programs in Canada, and in particular, a province-by-province summary of activity.
- A high-level review of the prevalence, type and key drivers for private property I&I programs in the United States (US), and in particular, a summary of activity in Washington State.
- A list of good practices being employed in other jurisdictions for managing private property I&I.
- Specific examples of sewer bylaws in Canada that address good practices for managing private property I&I.
- An understanding of how CRD compares relative to other jurisdictions with comparable contexts.

The updated information in intended to support the CRD as it embarks on further discussions among staff and elected officials in determining which approach is most suitable to its context. Appendix A provides an updated version of the table included in Appendix A of the 2011 and 2014 Report(s).

2 2022: Summary of Findings

Research conducted in 2022, including a desktop review and interviews, gleaned the following key findings:

- Most programs identified in 2014 are still in place in 2022. Where programs are no longer running, reasons for de-activation include: the lack of financial resources to continue to support the program, the impacts of the COVID-19 pandemic, and in one case, a program was cancelled for reasons unknown.
- Several jurisdictions highlighted in Appendix A have new programs in place (6 total) where all but one of them is an incentive-based approach. The City of Windsor has adopted a Mandatory Downspout Disconnection Program in targeted areas.
- A few jurisdictions have indicated that the only change to their program includes an increase in the percent or total dollar amount of rebates given. This is to reflect the realities of cost differentials between 2014 and 2022.

- One jurisdiction (Costa Mesa CA) changed their program to be proactive rather than reactive, and now has a CCTV program that they hope residents will participate in every 5 years.
- Due to the COVID-19 pandemic, several jurisdictions are no longer collecting late fees and / or penalties – to lessen the financial hardships already being experienced by residents. Further, the pandemic has shifted some outreach where fewer door-to-door visits are conducted.

The primary drivers of PPI&I programs continue to be those noted next, however, a few jurisdictions have pointed to specific extreme weather events that have triggered ongoing PPI&I work and / or have motivated residents to act by using existing programs.

3 Private Property I&I Program Drivers

As identified in the 2011 Report, BC municipalities have the legal authority to implement numerous types of programs to address inflow and infiltration from private property. To assist with identifying the most appropriate approach(es) for CRD member municipalities, this report seeks to clarify the reasons programs are being implemented in other regions (i.e. what is driving those regions to act) in relation to the types of approaches that are being employed.

Sewer systems in the CRD are “separated” – that is, the sewage is conveyed in a separate network of pipes than the storm water. The only exception is the “combined” sewers in the Uplands area of Oak Bay where the same pipes convey both sewage and storm water. Communities with combined systems have a different set of priorities and drivers, and tend to focus on ways to divert rainwater from the system altogether (e.g. by disconnecting downspouts from the collection system), or ways to minimize damage (e.g. by installing backflow prevention valves). These combined programs are generally not very applicable to the CRD context, so this research focuses on programs that are targeted at separated systems.

Based on the research conducted, it is estimated that less than 5% (and likely closer to 1%) of US municipalities with separated sewers have I&I programs specifically for addressing private property. In Canada there are very few such programs.

The primary drivers for PPI&I programs focused on areas with separated sewers typically fall into one or more of the following:

1. **Senior government requirements**: In numerous municipalities throughout the US, the EPA and/or State authorities have ordered sewer agencies to take action to reduce sewer overflows into fresh water in order to bring them into compliance with the *Clean Water Act*. In many locations, these orders specifically require action to be taken on private as well as public property. This is also the case in a selection of Canadian municipalities that have been ordered to comply with Federal *Fisheries Act* requirements.
2. **Basement backups or flooding**: Many communities across Canada and the US have identified the need to reduce basement backups and flooding that cause damage and

health concerns for private property. Primarily these programs relate to municipalities with combined sewers and focus on disconnecting downspouts from the sanitary sewer system, and/or removing illegal cross connections (when a storm water pipe is connected to a sanitary sewer).

3. **System capacity**: Communities are experiencing system capacity issues, where urban densification and/or new development puts strain on an existing sewer system. This can result in sewage overflows at specific locations during rainfall events. In some places, regional sewer authorities set capacity limits or costs for exceeding certain flow allotments, and this drives municipalities to develop PPI&I programs.
4. **Infrastructure maintenance and treatment costs**: A few municipalities cited that they developed their programs in a proactive manner, as part of long-term maintenance planning and/or to reduce treatment costs. More typically, this driver is a secondary reason or benefit for implementing a program.
5. **Climate change:** Since 2014, extreme weather events, including storms that lead to flooding have been noted in communities in both Canada and the US as contributing to the need for private property I&I programs.

Implementing private property I&I programs can be resource intensive and politically challenging, particularly when significant costs and/or burden are borne by property owners to fix a problem they were not even aware of. The first three drivers listed above are strong enough to support significant PPI&I programs. The fourth driver is weaker and by itself generally is not strong enough to maintain the political support needed for a significant I&I program targeting private property. The fifth driver is new to the report since 2014, and will likely continue to influence the need and desire for PPI&I programs, as the climate continues to change and communities across North America experience an increase in extreme weather events, including heavy precipitation and flooding.

The following table illustrates examples of programs in relation to the primary drivers identified.

Program driver	Examples of programs implemented
1 – Senior government requirements	An ordinance requiring a lateral be inspected and fixed at the point of sale of a property is highly effective, while also placing significant onus on the property owner at a time when they would not normally be undertaking that type of work. Of the over 20 point of sale programs identified across the US, all but two communities are under an order or decree with the EPA to take action to reduce sewage overflows. Other communities under federal orders decided to have the agency undertake the repairs, rather than requiring the property owner to do the work (e.g. Westlake OH and Fort Erie ON), or have insurance programs requiring all property owners participate.
2 – Basement backups or flooding	Many programs driven by a desire to reduce basement backups or flooding have insurance programs in place where an annual fee is added to utility bills and claims are made if a backup occurs. Other regions undertake testing then serve notice to property owners to fix problems identified (e.g. Halifax NS, Kingston ON). Numerous regions provide voluntary incentive programs to install backflow valves or disconnect downspouts to alleviate this flooding.

	One point of sale program was found that was driven by the need to reduce basement backs or flooding (Rock River IL).
3 – System capacity	There are a number of communities in the US that are not under agreements with the EPA, but are facing limits on system capacity. Programs in these areas include one point of sale program (Golden Valley MN), and several with an ordinance requiring inspection and repair of laterals at the time of major renovations (e.g. Lakeport CA, Santa Barbara CA and Ukiah CA). This approach is less onerous for the property owner because they are already engaging in a significant renovation project. One point of sale program was also found that was driven by limitations for new development (Golden Valley MN). At a regional scale where there are system capacity concerns, some regional agencies have set targets for each member municipality, then monitor wet weather flows to see if the targets are being met. If not, communities must respond by creating I&I management plans, increasing spending on I&I reduction efforts, or face surcharges. The result has been municipal programs that include grants for private sewer lateral replacements, targeted inspections followed by orders to do work where needed, and/or point of sale programs (Metropolitan Council of Environmental Services MN, Metropolitan Sewerage District WI).
4 – Infrastructure maintenance and treatment costs	Where the programs are in place in a more proactive manner, the typical form of program is a voluntary approach providing education, rebates, and in some cases, a requirement to inspect and repair laterals during major renovations. Examples include Tacoma WA (requiring education at time of sale), Costa Mesa CA and Brantford ON (incentives for repairs), and District of North Vancouver BC (requiring inspection and repair at time of renovation).
5 – Climate change	Several communities (Windsor ON, Westlake OH, Eagan MN, and Naperville IL) pointed to specific extreme weather events (i.e. heavy rains / flooding) that led to an increase in uptake of existing program offerings. MMSD reported that severe storms (2008 through to 2010) caused thousands of basement backups resulting in the announcement of a regional Private Property I/! (PPII) reduction program and the development of a comprehensive PPII policy.

4 Private Property I&I Programs – Canada

4.1 Drivers for Programs in Canada

Two Canadian municipal private property I&I programs were identified in the 2011 Report: the Town of Fort Erie Extraneous Flow Program, and the City of Thunder Bay Downspout Program. Each of these programs was formed in response to drivers that are not directly applicable to the CRD context. In Fort Erie, the program developed in response to a *Remedial Action Plan* created by Environment Canada and the Province of Ontario that was put into place to protect the Great Lakes from sewer overflows (driver #1 – senior government requirements). Some financial support for the program was also provided by Environment Canada. In Thunder Bay, the PPI&I program focuses on separating combined sewers by disconnecting downspouts.

Additional research was conducted to ascertain how many other communities in Canada have programs or approaches for addressing private property I&I. The research indicates that most of these programs are aimed at reducing basement flooding. The following table summarizes the

findings, including a summary of the drivers for the programs, and whether the program focuses on inflow sources (cross connections or combined sewers), or infiltration (leaky laterals). This table has not been updated since 2014.

Province	Program summary and drivers
Newfoundland	None identified.
Prince Edward Island	One program (Charlottetown) focuses on inflow removal in a combined system.
Nova Scotia	One program (Halifax Water) targets removal of improper rainwater connections into the separated system. Focus is on ensuring downspouts connect to the storm water system, and removing cross-connections.
New Brunswick	One program (Moncton) provides rebates for installing backwater valves to prevent basement flooding.
Quebec	One pilot project to disconnect downspouts (Quebec City) from a combined sewer system.
Ontario	Over a dozen programs, and almost all are driven by reducing basement flooding predominately in areas with combined sewers. Some are related to federal requirements to improve Great Lakes water quality. One community cites long-term infrastructure maintenance as the driver (Brantford) and one cites reducing costs for homeowners to do repairs as the driver (Windsor). Several provide rebates for disconnecting downspouts, or for redirecting storm water out of the sewer system. Two provide rebates for fixing sewer laterals (Brantford and Windsor). One provides financing for sewer lateral repairs (Cornwall). One regional I&I reduction strategy that identifies the need to improve private property sewer maintenance, and a commitment to identify an appropriate approach (York).
Manitoba	Provincial grant program currently provides funding to 22 municipalities to provide rebates for installing backwater valves to prevent basement flooding. Winnipeg still has 30% combined sewers.
Saskatchewan	Two programs (Saskatoon and Humboldt) provide rebates for installing backwater valves to prevent flooding. Separated systems in Saskatoon and Regina.
Alberta	One program (Edmonton) for flood prevention on a largely combined system. Also a private insurance program for basement backups. No program for Calgary, which has a separated system.
British Columbia	Two bylaws requiring lateral inspections / repair during major renovations or re-development (North Vancouver and Surrey). On a very small scale, municipalities have completed targeted I&I removal projects to remove cross-connections and repair laterals on private property. Metro Vancouver and CRD have identified policy and legal options for managing private property I&I.

4.2 Summary of Program Activity by Province

The following provides more detail about the programs identified that address private property inflow or infiltration in some form, organized by province. Where programs have elements that may be of interest to the CRD were identified, these were incorporated into the table in Appendix A (and are marked with an asterisk * below). The summary provided in Section 4.2 has not been updated since 2014. Appendix A was updated in 2022.

Newfoundland & Labrador: The Province undertook a study in 2012 to identify location and frequency of CSOs, SSOs and potential solutions, province-wide, in response to the proposed WSER (legislation for Municipal Wastewater Effluent, under the Federal *Fisheries Act*, enacted 2012). No community was identified that had any reference to a private inflow and/or infiltration program (though Mount Pearl has a successful cross connection control project).

Prince Edward Island: The City of Charlottetown was the only community identified with private property program, and it focuses on the removal of inflow sources.

- Charlottetown: Inflow reduction education campaign. The primary purpose is to reduce the numerous illegal connections of inflow identified. Concurrently, the City is working to separate their sewer system.

Nova Scotia: The Province is developing a wastewater standard to address the objectives of the WSER, including an approach to overflows. At a community scale, Halifax has been working to reduce inflow and infiltration since 1999. The utility Halifax Water formed in 2007 and has had a private side program for I&I reduction since 2008. No other communities were identified that have a private property inflow and/or infiltration program in Nova Scotia.

- Halifax Water*: Stormwater Inflow Reduction (SIR) program in place several years with an exclusive focus on private property I&I. The program includes: targeted inspection of private I&I sources through smoke, dye, and CCTV testing; notices to owners where repairs are needed; and follow up notices if work is not completed. A bylaw is in place to enable various forms of enforcement (shutting off water service, issuing tickets, placing property liens). The program previously included CCTV inspections of laterals from the inside of the dwelling, though this was onerous to conduct. The focus of the program is currently only on inflow sources.

New Brunswick: All municipalities are required to develop long-term plans to reduce combined sewer overflows and reduce overflows from infiltration by January 1, 2016. One existing private property program was identified in Moncton.

- Moncton: Backwater valve incentive program ($500 towards installation) to reduce basement flooding. City has both separated and combined sewers.

Quebec: One program was identified in Quebec with respect to private property inflow and infiltration (note: web searches were conducted in English only). This program focused on the reduction of basement flooding.

- Quebec City: Required downspout disconnections for one neighbourhood, funded by the City (launched 2005). Program results: 25% uptake on first round; 60% of remaining on second round; five more rounds, including warnings of $300 fine for not complying, and reached 100% compliance by early 2008. City has primarily combined sewers.

Ontario: Numerous programs were identified in municipalities and/or regions across Ontario, and four of these have been added to the table in Appendix A (as indicated by an asterisk*). Over a dozen programs were identified that addressed private property I&I in some form, and some of these are regional and cover numerous municipalities. Generally the programs are focused on reduction of inflow, and cite the reduction of basement flooding as the primary driver for having a program. The most comprehensive strategy identified for managing I&I was the York region.

- York Region* (Newmarket, Richmond Hill, Vaughan, Markham, and 5 others): Comprehensive I&I strategy addresses public and private sources. Planned and tendered a pilot project to conduct inspections and repairs for 3,000 private laterals to determine most cost-effective method of reducing I&I. After tendering, the Region changed the scope of the project to only focus on the public portion of the lateral due to uncertainties about the legal implications should any damage to private property occur during the project. The strategy also identifies the need to address private property I&I through one or more of the following: increased education, incorporating lateral information into GIS, developing region-wide standards for private side inspections, and investigating long-term program options (including time-of-sale certification of laterals and subsidy programs) – though these have not been implemented to date.
- Brantford*: Grants to replace ageing sewer laterals (50% up to $1,500) started in 2014. City also took back ownership of lateral from property to main effective 2014.
- Windsor*: Grants to replace ageing sewer laterals (up to $2,000 once every 20 years).
- Kingston*: Grant program to reduce basement flooding, and stronger bylaw language adopted in 2012, including enforcement measures if private sewer laterals are not properly maintained.
- Cornwall: Sewer Lateral Replacement Financing Program.
- Niagara Falls: Grants for disconnecting foundation drains (100%), and a free service to inspect the condition of a private lateral upon request. Driven by Federal and Provincial requirements in relation to protection of the Great Lakes basin.
- Port Colbourne: New *Sewer Use Bylaw* supporting an Extraneous Flow Reduction Program enabling the City to undertake inspections of private laterals to identify need for repairs, and to provide grants for some or all of the repair work. Driven by Federal and Provincial requirements in relation to protection of the Great Lakes basin. Combined system.
- Hamilton: Proposed insurance program where residents voluntarily pay a monthly fee for sewer lateral insurance. Generally considered a reactive approach as laterals are fixed after a backup or problem becomes evident.
- Region of Waterloo: Storm sewer inspection program using video to identify areas that require rehabilitation. All storm sewers to be inspected and flushed over five years.
- Several other municipalities: Downspout and foundation drain disconnection programs, including grants to assist with the costs of disconnecting, are quite common across Ontario. Other municipalities include with these programs include Toronto, Ottawa, Halton Region, Region of Peel, Brantford, London, Durham Region, Greater Sudbury, St. Catharines, Vaughan, Welland and Cornwall.

Manitoba: Grant program that provides funding for installation of backwater valves and sump pits is provided to 22 municipalities across Manitoba, and is jointly funded by the two levels of government. Significant focus province-wide is on reducing flooding risks.

- Winnipeg: The City is an early adopter of a bylaw requiring backwater valve installation (1979). City also has a grant program to reduce basement flooding, including backwater valve and sump pit installation rebates. 30% of the city still has combined sewers.

Saskatchewan: Two programs were identified in Saskatchewan, and they focus on reducing inflow. A program was previously available for Prince Albert but no current reference found for this. The focus of these programs is reducing flooding risks.

- Saskatoon: Grant program to reduce basement flooding for backflow preventer installation, foundation drain disconnection, and sump pump installation. Program had general public resistance and slow uptake. All homes built 1965 to 2004 have foundation drains connected to the sanitary system.
- Humboldt: Storm Water Rebate Program is similar to the Saskatoon program and focuses on flood prevention.

Alberta: One private property inflow reduction program was found in Edmonton. In 2011, EPCOR Utilities announced a joint marketing agreement for service line warranties with HomeServe. This is a voluntary insurance program.

- Edmonton: Grant program to reduce basement flooding in place since 1991. City has combined sewers.

British Columbia: Two municipalities in BC require the rehabilitation or replacement of sewer laterals at the time of major renovations and re-developments (e.g. City of Surrey and District of North Vancouver) and some municipalities have “rodding lists” (e.g. City of Vancouver and District of North Vancouver) to perform regular clearing of laterals on the public side.

- District of North Vancouver: all building permits of value greater than $150,000 with connections over 30 years old must demonstrate the lateral meets MMCD or equivalent standards. Also, since the 2011 Report, the District of North Vancouver undertook a project to reduce I&I from private properties in Lynn Creek. Metro Vancouver undertook a study of how to implement a private sewer lateral certification program at the time of property sale, but have not yet taken steps to implement this.
- City of Surrey: all applications for a service connection with a building permit of value greater than $100,000 or where a parcel is being redeveloped must demonstrate their lateral is in good condition (if under 30 years old), or replace it (if over 30 years old). All no-corrode, asbestos cement or clay service pipes of any age or condition must be replaced.
- Metro Vancouver and CRD: both regional districts have reports (including the 2011 Report) that identify the policy options and legal authority for municipalities to develop and implement programs to address private property I&I. Metro Vancouver also has a Sample Bylaw for private sewer laterals.
- Some municipalities have undertaken work on private property laterals to get them into better condition as part of targeted I&I reduction projects (e.g. James Bay in Victoria, Lynn Creek in North Vancouver)

In summary, the vast majority of communities in Canada with private property programs are driven by the need to reduce basement flooding, and a couple of programs are in relation to senior government requirements. The more proactive programs identified that apply to separated sewer systems were in Brantford Ontario – a rebate program for repairing a private lateral, and in North Vancouver and Surrey – bylaw requirements to inspect and/or fix private laterals at the time of renovation or re-development.

5 Private Property I&I Programs – US

5.1 Drivers for Programs in the US

Twelve programs from the US were reviewed in the 2011 Report. This memo clarifies what were the key driving forces for developing the programs (see updates for each program in Appendix A, including a new column "Primary drivers for the program"). The majority of the examples presented in the 2011 Report were driven by senior government requirements (driver #1) because the EPA had issued administrative orders or consent decrees due to violations of the Federal *Clean Water Act*. The others were related to capacity concerns (driver #3) as follows:

- **Senior government requirements** (EPA): McMinnville OR, Berkeley CA, Brentwood and Glendale MO, Austin TX, Miami-Dade FL
- **Capacity** (reduction of sanitary sewer overflows): Santa Barbara CA, Westlake OH, Costa Mesa CA, Naperville IL
- **Regional surcharges** to municipalities for wet weather flows: Eagan and Golden Valley MN (note – these regional surcharges are driven by desire to reduce spills and increase capacity)

This list highlights the primary drivers, although in most cases communities cite numerous drivers for taking action. There are, however, useful examples from communities that are not facing US EPA orders (e.g. Costa Mesa CA, Santa Barbara CA, Metropolitan Council MN communities). Note that all US examples in the 2011 Report have fully separated sewer systems, or where there are combined systems, the focus of the private property program has been on areas with separated systems.

5.2 Summary of Program Types and Drivers by State

In 2014, a high-level scan of programs in place across the US identified upwards of 100 communities with some form of private property I&I program. Without a more in-depth study a more precise estimate is not possible, however the overall number is likely in the hundreds of programs, and not likely to be as high as thousands of programs. For context, that is less than 5% of municipalities, and more likely close to 1%.

In 2014, PPI&I programs were found in 21 states. California municipalities appear to have the most number and types of programs (e.g. required education, renovation ordinance, point of sale ordinance, agency undertaking the work on private property, rebate programs, loan programs). Very little activity was found in the Pacific Northwest other than a required education program in Tacoma, a number of pilot studies in King County, and loan programs for low-income households.

The results of the scan are summarized by state with a brief indication of the type and driver for the programs:

Alabama: 1 EPA order found – agency fixes laterals in examples found

California: Several EPA orders – most have point of sale programs
Non-EPA cities – some have ordinance requirements for renovations (but not for

point of sale), rebates, “required education” (information is provided during real estate transactions on property reports)

Colorado: Basement backup prevention

Florida: EPA order for Miami-Dade – program required property owners to fix problems identified

Illinois: Mostly downspout/foundation drain disconnection programs
Some programs where City does the work to fix laterals on private property

Indiana: Mostly downspout/foundation drain disconnection programs
2 insurance programs (where property owner pays monthly fee, then insurance covers repair/replacement costs if problem found)

Kansas: 1 rebate program
Some downspout/foundation drain disconnection programs

Kentucky: 1 rebate program
1 downspout/foundation drain disconnection program
1 program where the agency fixes private laterals

Michigan: Several programs where the agency fixes private laterals

Minnesota: EPA orders with point of sale ordinances
MCES also has regional requirements related to capacity – 1 city in MCES has a point of sale program due to capacity
1 agency requires property owners to undertake fixes, but agency pays 50%

Missouri: EPA order for St Louis County
Numerous insurance programs

Ohio: EPA orders – 1 agency fixes the private laterals; 1 has a point of sale ordinance
Non-EPA cities have downspout disconnect programs

Oregon: EPA order for McMinnville and city requires property owners to fix problems identified

Pennsylvania: EPA orders – several have point of sale ordinances and/or city inspects and requires property owners to fix laterals

South Carolina: 1 rebate program
1 city that fixes private laterals

Tennessee: 1 city that fixes private laterals

Texas: EPA order for Austin – city requires property owners to fix problems
Dallas also requires property owners fix problems, no EPA order found
2 low income programs
Backflow preventer program

Virginia: 1 Region with municipal flow commitments
1 downspout disconnection program

Washington: Loan and low income programs
King County pilot studies (where County fixed laterals to assess cost effectiveness
Tacoma has a required education ordinance for point of sale, but no requirement to inspect or do work

Wisconsin: Education and loan programs

Wyoming: 1 insurance program

5.3 Washington State Approaches

Of particular interest to CRD are the approaches undertaken by their neighbours in the Pacific Northwest.

King County in Washington State is engaged in a long-term program, in collaboration with local wastewater agencies, to reduce I&I when cost effective to do so in the separated sewer systems.

In 2014, this program had been entirely agency-led and had not put any onus on property owners, other than to obtain their permission to complete the rehabilitation projects. All work and costs were borne by the County. I&I reduction projects involved the rehabilitation of public and private sewers in select basins where expected reductions are deemed to be cost effective (because they will avoid the cost of future storage and diversion needs).

In 2015, the Metropolitan Water Pollution Abatement Advisory Committee (MWPAAC) I&I Task Force was created to formulate ideas for I&I programs that could benefit the regional wastewater system by looking at long-term solutions to significantly reduce and remove I&I from the sewer system as a whole.

The first phase of this work (2017-2019), which has been completed, was a planning phase and aimed to explore different concepts to reduce I&I programmatically and with a focus on private side sewers. Concepts included region-wide side sewer standards and inspection training, interagency coordination to identify and manage I&I, side sewer inspection and repair programs, and side sewer grant/loan programs. This planning phase resulted in three programs being recommended by MWPAAC for further definition and consideration, they are:

1. Regional sewer and side sewer standards
2. A regional inspector training and certificate program, and
3. A private side sewer inspection program with financial assistance

As of 2022, planning has led to the definition of two program options. The regional best management practices were recommended by MWPAAC for voluntary implementation by component agencies (largely community education) while the training and certificate program was not recommended. The third program listed above was not completed because it is being considered as part of a broader sewer system planning effort.

No programs were found for the City of Seattle, or other municipalities in King County.

The City of Tacoma attempted to proactively implement a time of sale program without a strong driver such as an EPA order. The program lost political support just prior to implementation. Further details are provided in Section 5.2, which highlights some problems communities have faced when implementing these programs.

The result was that, effective 2010, Tacoma realtors are required to provide the City's information package on sewer laterals to both buyers and sellers prior to closing of a property. The City also provides the package to any property owners who request a building permit. The package recommends conducting a sewer lateral inspection prior to completing the purchase or

renovation on any home more than 25 years old. The City has levied a few fines against realtors who did not hand out the package, and the homes later encountered sewer problems. Anecdotal information from City staff suggests that there has been an increase in the number of sewer lateral inspections being conducted during real estate transactions. The City has also made information about the condition of sewer laterals available on their property search website, along with all other permit information, and includes age and condition of the lateral where available. City staff continues to review options to further develop programs for I&I removal from private property.

Since 2014, little has changed at the City of Tacoma, however, a conversation with staff at the City revealed that although the realtor program is still occurring, there are few ways to enforce it, and therefore no clear way to know if the program is being implemented. The City did report an increase in residents that are having sewer issues and coming to the City for support, which may be as a result of more frequent wet weather events or turnover of homes in an active real estate market.

6 Example Problems Related to PPI&I Approaches

6.1 Inadequacy of Education Alone

It has been found that education alone is not effective for reducing PPI&I. Some communities that originally opted to pursue purely educational approaches are now finding that it is time to re-evaluate options for further addressing private property I&I.

For example, a 2014 staff report from Laguna Beach City in California states that the City's 10-year awareness program has been ineffective, and it is now seeking to update the program. The program involved educating owners about lateral inspection and maintenance, and encouraging voluntary action. In 2022, the City is implementing a Private Sewer Lateral Repair Program where the City offers an incentive to encourage and assist homeowners with the repair or replacement of their sewer lateral line. The City of Laguna Beach will reimburse up to 50% of the homeowner's cost to repair or replace a private sewer lateral, up to a maximum of $1,600 per residential parcel.

6.2 Loss of Political Support

The City of Tacoma proactively updated their Municipal code to directly address private property sewer laterals (called "side sewers" in Tacoma). This program was originally designed to be more prescriptive by requiring a "Certification of Inspection" be obtained from the City prior to completing a home sale. The intent of the original program was to ensure prospective homeowners understood the current state of the sewer lateral prior to completing the purchase. The City developed the original program based on two years of consultation with the real estate industry and other stakeholders. However, shortly before the ordinance was to come into effect Council directed municipal staff to significantly reduce the requirements of the adopted PPI&I ordinance in response to pressure from real estate agents. No changes to this program have been made since 2014.

6.3 Liability Fears Related to Working on Private Property

The Regional Municipality of York engaged a consultant to conduct a condition assessment, detailed design, contract administration and site inspection services for about 3,000 private property sewer laterals throughout the region (for a value of 1.06 million dollars) in the fall of 2013. However, during early project planning, the regional municipality's legal department became concerned about the potential liabilities associated with working on private property. The project scope was then changed to only include the inspection and rehabilitation of the service lateral (from the main to the property line). The region is currently considering other avenues for evaluating and rehabilitating private sewer laterals, as these have been identified as an important part of their comprehensive I&I reduction strategy.

7 Good Practices for Addressing PP I&I

This section outlines a collection of good practices for addressing PPI&I. It is based on the research conducted for the previous sections of this report and a review of best practice research conducted in other regions.

7.1 Clear Vision, Mission Statement, Goals and Scope

Establishing a well-defined vision, mission statement, goals and scope will support the development of the program, and provide structure at decision-making points. This includes having a strong understanding and agreement on the drivers of the program, and buy in from stakeholders and local government / agencies. The scope can be adjusted over time to meet the needs of the program and jurisdiction.

7.2 Bylaws Pertaining to Private Sewer Laterals

A good practice identified by numerous agencies is to first conduct a review and update of existing bylaws to ensure they are explicit about several important aspects of sewer lateral maintenance. The 2011 Report outlines the options available to municipalities in CRD for managing private sewer laterals, and also provides a sample bylaw that was developed for Metro Vancouver municipalities (attached as an appendix to the 2011 Report).

Appendix B contains sections from Canadian municipal bylaws relating to PPI&I. It demonstrates how PPI&I approaches can be implemented through bylaws and is organized by the following key elements:

- **Responsibility of owner** – to clearly state property owner responsibilities in maintaining laterals
- **Cleanouts required** – to assist with future testing and access, some municipalities require cleanouts be added under certain trigger conditions
- **Entry and testing** – to state the legal authority for the municipality to enter private property to conduct testing, and to undertake work; this section usually identifies part or all of the process to be followed (e.g. type of communication, amount of advance warning provided)
- **Require fix of defects** – to state the legal authority for the municipality to require property owners to fix defects; this section usually identifies the circumstances that will trigger this requirement

- **Require inspection for renovation or new construction** – a special condition currently found in two bylaws stating laterals must be tested and/or fixed when undertaking major renovation or new construction
- **Fees, recovering costs** – to state the authority for municipality to do the work then recover the costs from the property owner
- **Financial assistance, monetary incentive** – to identify the purpose and authority to provide financial assistance for fixing laterals; note that many grant programs don't explicitly identify this in their bylaws
- **Enforcements, penalties** – to clearly state the enforcement approach and penalties that may ensue for non-compliance

This summary of key elements of a sewer lateral bylaw is not exhaustive (see the 2011 Report for a more extensive list and description). It does highlight the need for clearly stating the municipal authority to enter onto property, test, inspect, require fixes, charge fees and enforce penalties for non-compliance.

7.3 Testing Private Property I&I

With respect to entry and testing, no Canadian bylaws reviewed provided details of the method of testing or inspection that would be conducted (though this is present in several US ordinances reviewed). Several municipalities in Canada do have testing programs primarily employing smoke testing to ascertain whether inflow sources are illegally connected to the sanitary sewer system. Municipalities that have undertaken smoke testing for this purpose have outlined their testing policies and procedures on their website. These procedures include providing notice to property owners with dates and times of upcoming smoke testing, providing notice to emergency services (fire, police) of the location, dates and times of smoke testing, and providing answers to Frequently Asked Questions with the notice and on their websites.

Examples of the notices and/or procedures for conducting smoke testing programs include:

- London ON: Report from staff to Council Committee outlining the procedures to be followed and an example public notice to be provided to property owners.
- Markham ON: Website provides overview of purpose, links to sewer bylaw and requirements being tested, maps of program areas to be checked, links to Council Minutes relating to the program, other educational information, and a rebate program to assist with disconnecting downspouts and/or installing rain barrels.
- Halifax NS: Written notice of smoke testing is provided to properties in advance of testing, police and fire is notified each day prior to testing.
- Regional District of Nanaimo BC: RDN notice of smoke testing listing specific times and dates that testing will be conducted in specified locations for the purpose of identifying cross connections.

Examples and links of notices / procedures conducted since 2014 can be found in Appendix C.

7.4 Standards, Guidelines and Policies

In addition to reviewing and updating bylaws, many communities also review and produce or update standards for construction of private sewers, guidelines for executing private property rehabilitation, and policies that ensure standards and guidelines are applied consistently.

The region of King County developed a comprehensive set of Standards, Guidelines, Procedures and Policies for use in long-term I&I control (2004). The document addresses both public and private infrastructure, and is based on the first five years of experience in I&I control projects. The 15 policies are designed to support the application of standards and guidelines in I&I control projects, and address the issues of: funding, public education, access to private property, inspection, permitting, liability, and storm water drainage. The County plans to review and update the document as needed following the completion of larger scale projects, which have just come to completion.

The Region of York is developing region-wide standard procedures for private side inspections, including notification materials and consent/ waivers. They plan to use a standard ROE (Right of Entry) form across the region, to be signed by the property owner.

For agencies that issue a sewer lateral certificate of compliance, more recent programs are distinguishing between watertight laterals (which receive a 25-year certificate) and laterals in good condition (which receive a 10-year certificate). To receive a 25-year certificate, laterals must pass a hydrostatic pressure test. 10-year certificates are issued to laterals that pass a CCTV inspection.

In 2018, the CSA Group published Z800-18- Guideline on Basement Flood Protection and Risk Reduction to provide guidance on making homes safer and more resilient against flood-related events. The guideline, a response to the effects of the changing climate has the goal of helping people “feel safer in their homes through flood protection and avoid the high costs associated with repairs”. In addition to providing measures that can be taken in existing, new, rebuilt and renovated houses under the National Building Code of Canada (NBCC) Part 9, the guideline also serves as the basis for the curriculum of a new training course for home inspectors.

7.5 Communications and Education

Education alone will not result in noticeable changes in I&I; however, all agencies agree it is essential to have a strong focus on this when implementing any program. Effective campaigns in Canadian communities have occurred in conjunction with targeted programs that have strong regulatory backing cited in the communications material.

In Halifax, the utility (Halifax Water) contacts property owners requiring them to take action on their improperly connected downspouts or cross-connections when smoke testing reveals problems. The program initially had an uptake rate of approximately 40% of property owners that responded to Halifax Water's communications. This rate increased to 90% uptake last year after improvements were made in the communications methods, including:

- Improvements in customer care, including longer hours of availability (to 8pm) and email communication,
- Increased staff,
- Virtual open houses where residents are asked to be proactive, and
- Addition of door-to-door knocking when staff is already out in a neighbourhood.

Other communities such as Tacoma have taken advantage of natural times to communicate with property owners and provide education about I&I – at the time of property transfer (through realtors) and at the time of major renovation (through the City building permit department).

Lateral certificates are another tool used to educate the public on their responsibility to maintain their private property laterals. In general, lateral certificates certify compliance for a period of time (e.g. 10 or 20 years). The City of Lakeport CA has a voluntary certification program for this purpose.

7.6 Checkpoints for Long-term Maintenance

Communities under EPA orders to reduce inflow and infiltration are typically required to put into place ordinances that ensure private laterals will be inspected and rehabilitated at regular checkpoints on an ongoing basis, in addition to taking immediate actions to reduce sewer overflows. This demonstrates a good practice for long-term maintenance, which is also being implemented by some communities more proactively. Checkpoints (or triggers) for inspection are typically one or more of the following:

- When a property is re-developed
- When obtaining a building or plumbing permit exceeding a particular value
- At a particular age of lateral (e.g. laterals 25 years old)
- When a property changes use (e.g. from residential to commercial)
- Time of sale of property, name change on municipal / utility account (not common in proactive programs)
- When work is being conducted in the area on community roads / laterals

These are typically designed to try to align with commitments to regular inspection on the public infrastructure. The use of the age of lateral checkpoint is more common with commercial properties. York Region, Halifax Water and Metro Vancouver are investigating options to put a longer-term checkpoint into place. Both Halifax Water and Metro Vancouver have had preliminary discussions with the real estate industry regarding the option to include the condition of the sewer lateral on property disclosure statements.

7.7 Data Collection and Management, Including Defined Performance Measures

Developing data collection approaches, and defined performance measures that align with the vision of a program will help ensure the sustainability of the program. In addition to the tracking information noted next, communities should develop approaches to track program information, including, the number of laterals inspected / repaired on an annual basis and the cost of implementation to the community.

Communities are tracking information about the condition of private laterals and incorporating the data into broader sewer information systems. For example:

- The City of Kingston used a GIS overlay of the location of flooding complaints to target their program efforts towards those catchments.
- The City of Tacoma publishes known information about private sewer laterals along with permit information for all properties in the city, publicly accessible through a web-based interface.

- The Region of York plans to develop an inventory through a review of historic plumbing records, combined with all new inspections conducted to better understand the state of the private system.
- Many communities are monitoring I&I rates before and after rehabilitation work.

These good practices are being demonstrated in various programs throughout Canada and the US. To date, no region in Canada has put in place a comprehensive program that incorporates all of these elements.

7.8 Program Management, Sufficient Staffing, and Acceptable Technologies

Communities implementing I&I programs should have strong program management processes in place, and knowledgeable staff to spearhead the program. In most cases, jurisdictions involved in this review had one person who was the lead on the I&I programs, and could ensure its effective delivery. Prior to implementation, a decision about who manages the program should be determined, including whether it is internal or external (i.e. a consultant) and if it is internal, choosing an individual to champion the program.

Appropriate practices and technologies relevant to the type of I&I program that will be implemented also need to be identified. These might include written policies and procedures, technical specifications, approved methods and materials, and inspection criteria. Further, appropriate and efficient tracking mechanisms should be adopted such as databases and websites.

Appendix A – Survey of I&I Programs in Other Jurisdictions – Updated 2022

Key findings and updates to Appendix A (2022):

- Six new programs in place:
  - Basement Flooding Grant (Brantford ON)
  - Mandatory Downspout Disconnection (City of Windsor)
  - Sewer Lateral Repair Program (Brentwood, MO)
  - Sewer Inspection Rebate Program (Costa Mesa, CA)
  - Sewer Lateral Inspection Program (Santa Barbara, CA)
  - Sanitary Sewer Backflow Prevention Device Program (Naperville, IL)
- Four programs no longer running:
  - Due to COVID-19 Pandemic (City of Kingston)
  - Lack of funding (Santa Barbara, CA)
  - Lack of enforcement / no political well (Miami-Dade, FL)
  - Reasons unknown (Golden Valley, MN)
- Sewer rates for residents remain the same regardless of age of home – some communities charge different rates based on home type (i.e. house / condo / townhome).
- Where testing of private laterals occurs during routine testing on the public side, the following measures are put in place to eliminate liability:
  - Written permission is required from the property owner (Miami Dade)
  - Property owner is notified of requirement for inspection to occur (Santa Barbara)
  - Private property testing is support by an ordinance or bylaw (Town of Fort Erie, Halifax, Santa Barbara)
- Drivers remain the same, no indication that political will is causing any programs to be cancelled or delayed. Extreme weather events / adaptation to climate change has emerged as a driver since 2014.
- Rebates including total dollar amounts and percentages have increased slightly in some communities to reflect the realities of increased costs.
- Several communities have put a hold on penalties due to COVID-19 pandemic and financial hardships already being experienced by residents.

Jurisdiction	Program Approach	Program Description	Primary Driver(s) for Program	Program Impacts	Program Costs and Source of Funding	References
CANADA						
Town of Fort Erie, ON **Population 30,000** Program for separated system	Incentive Approach	**Grants to Property owners** for the costs of repairs made to reduce extraneous flow. 100% reimbursement to a maximum of: ○ $100 for the removal of roof leaders from the sanitary sewer ○ $500 for the removal of existing sump pump connections from the sanitary sewer ○ $2,500 for the removal of foundation drains connections from the sanitary sewer ○ $1,500 for the repair or replacement of a leaking private sewer lateral ○ $1,000 for the installation of an approved backflow prevention device	History of overflows to environment: in 1987 the Niagara River was designated an Area of Concern in the Great Lakes Basin by the International Joint Commission. In response, Remedial Action Plan created by Environment Canada and Province of Ontario. Snowmelt events have led to loading and trucking sewage out of overloaded pump stations.	90% inspections now complete. Residential: 24% infrastructure failures found in inspections Public: < 5% infrastructure failures Over 3 years the Town reduced extraneous flow from about 60% to about 40%. Now working to reduce from 40% to 20%.	Costs: 1. Crescent Park: Overall cost $211,743 to date. Approx $850/lateral, includes public side inspections. 2. Outside of Ward 3: Overall cost: 221,516 to date. Approx $990/lateral, includes public side inspections. Funding: ○ Annual budget deliberations ○ Federal funding (2007 $130,000; 2008 $80,000) ○ Regional funding	Extraneous Flow Reduction Subsidy Program By-Law 68-06 Being a By-Law to Regulate the Management of a System of Sewer Works and Drainage Works (3.8.5)
	Targeted Inspection Approach	**Inspection Requirements from Municipality** to customers to arrange for in-home inspections to complete a video of all private side sanitary sewer laterals. Program targets inspections to most flood-prone areas.				
	Regulatory Approach	**Sewer Bylaw** specifies: ○ Owner must allow access to building or premises for inspection, maintenance, repair ○ If problem identified, owner is notified to fix. Owner will pay costs incurred directly, or it will be added to the tax roll for the property. If a lateral is found to be non-compliant, the Town may terminate water service or				

Jurisdiction	Program Approach	Program Description	Primary Driver(s) for Program	Program Impacts	Program Costs and Source of Funding	References
		perform the necessary repairs if the owner does not after sufficient notice. The Town may then recover the full cost of the work from the owner through municipal taxes.				
City of Thunder Bay, ON **Population 110,000** Program for combined system	Incentive Approach	2020 Residential Drainage Rebate Program**:** ○ Targets areas that experienced sewage-flooded basements during heavy rainfall events, particularly in older residential/commercial neighbourhoods where downspout connections to the sanitary sewer (instead of storm sewers) were most common. ○ The City contracted with a private not-for-profit organization, EcoSuperior Environmental Programs, to aid property owners: • Sump Pump - 50% of the invoiced cost up to a maximum of $1,500.00 including labour, materials, permit and taxes • Backflow Prevention Valve - 50% of the invoiced cost up to a maximum of $1,750.00 including labour, materials, permit and taxes • Disconnect Weeping Tile - 100% up to a maximum of $500.00 including labour, materials, permit and taxes • Installation of new Storm Sewer Connection - 50% of the invoiced cost to a maximum of $1,500.00 including labour, materials, permit and taxes • Rain Barrel Program was introduced as one alternative to redirect downspouts. The City offered 45-gallon rain barrels with a $20 discount, available only to city residents with a water account	Alleviating basement flooding: reduce inflow and infiltration with significant focus on reducing inflow sources. Prior to the program, 70 100 basements would flood several times per year. Information provided in 2022 indicates that uptake of the program has slowed in recent years – this may be in part due to the pandemic, and it could also be as a result of the fact that many homes have already completed upgrades.	Information from the 2014 report indicated that, in total, 786 properties were identified, 64% of which complied and disconnected their downspouts from the sanitary sewer. Those properties not able to disconnect (for various reasons), are being dealt with as road/ infrastructure upgrades occur. Estimated savings of $980,000 from reduction of inflow and infiltration from 2000 to 2006. In 2021, 27 applications for the Drainage Rebate program were received. In total, there have been 800 applications to the program since it began.	Property owner pays. Estimated savings of $17,000/year which would have historically been paid out in overtime to deal with rainstorm events (based on 2 events per year). Estimated cost savings from reduced insurance claims is approximately $60,000/year.	Melissa Davidson / melissa@ecosuperior.org Lindsay Menard / lindsay.menard@thunderbay.ca
City of Brantford, ON **Population 98,000** Separated system	Incentive Approach	**Private Sanitary Sewer Lateral Replacement Grant Program**: In 2014 the City began offering a grant of 50% up to $1,500 to replace an ageing sewer lateral. The intention is to proactively prevent backups and to benefit overall I&I reduction. Note that the City also took back ownership of the laterals from the property line to the main effective 2014. This is the only grant program for laterals in Canada found that applies where the property owner is only responsible for the lateral to the property line. **Basement Flooding Prevention Grant:** Provides up to $2000 to help lower the risk of flooding, eligible work includes; disconnecting downspouts, disconnection of weeping tiles from sewer and reconnection to sump pump, and installation of a backwater valve. Only available to homeowners in North-East Flood Remediation Study Area.	Proactive program to prevent sewer backups into homes, and to benefit the overall I&I reduction goals of the City.		Since the Program was established in 2014, $435,000 in grant funding has been provided for a total of 333 grants. Staff are recommending $50,000 to be approved to allow this successful Grant Program to continue in 2019.	Staff report – Funding for Private Sanitary Sewer Lateral Replacement Grant Program Basement Flooding Prevention
City of Kingston, ON **Population 123,000**	Incentive Approach (inflow)	As of winter 2022, this program has been suspended: **Preventative Plumbing Program**: to reduce basement flooding: provide a grant to disconnect downspouts, sumps, weeping tiles. ○ Grant program does not cover lateral repairs, but will cover a video inspection of lateral. ○ Program manager actively identifies catchments with high flooding, sends letters to property owners, then goes door-to-door. Where external visual inspection is not enough, a CCTV is offered to determine if any illegal connections.	Reduce risk of sewage backup to homes and secondary driver is reducing strain on whole system, particularly by eliminating illegal connections.	Since the program began in 2012, $1,610,000 in financial assistance has helped 1,050 Kingston homeowners, including with the removal of 163 illegal connections to the sanitary system [statement from 2018].		Bylaw 2008-192
	Regulatory Approach (laterals)	**Bylaw** for maintenance of laterals: ○ Updated bylaw in 2012 to include enforcement option for City to disconnect water for not repairing structural defects within 30 days of written notice. ○ As of 2014, City has new enforcement tool to issue tickets ($200) for non-compliance.				

Jurisdiction	Program Approach	Program Description	Primary Driver(s) for Program	Program Impacts	Program Costs and Source of Funding	References
City of Windsor, ON **Population 233,800** Separated and Combined system	Incentive Approach	Grant program for replacement of old sewer laterals. ○ Grants to replace sewer laterals that are over 20 years old and in disrepair ($2000, $4000 or 50% on arterial/collector roads). ○ City created a pre-qualified list of private drain connection contractors that are eligible for the grant. ○ City also has an "Eeling program" where the City conducts clean-outs up to 3 times in a 24-month period for free, as long as the clean-out is for City tree roots.	Property owner is responsible for the sewer lateral up to the main. This program assists owners with rehabilitation costs, and with free eeling related to City tree roots.	Properties per year that obtain the rebates: 2018: 110 2019: 79 2020: 85 2021: 72 Approximately 700 to 1,100 properties per year participate in the Eeling program to remove tree roots from laterals.		Bylaw 4921 for Servicing of Private Sewer Connections By-law 26-2008
	Regulatory Approach	Mandatory downspout disconnection program for certain areas. Exemptions will be made on a case-by-case basis.	Due to recent flooding			
Halifax Water, NS **Population 414,800** Separated, except in some older parts (program applies to separated)	Regulatory Approach: Mandatory Inspection Program	**Private Property Inspection Program**: The Stormwater Inflow Reduction (SIR) program includes smoke, dye and CCTV testing of private laterals to identify sources of inflow, or significant infiltration if found. ○ Where repairs needed, notices given to owners to fix; follow up notices given if work not completed. ○ Bylaw in place that enables various forms of enforcement: may shut off water, issue tickets, or put liens on properties (where funds are owing). ○ Program targets both residential and ICI; tends to focus more heavily on ICI. Target properties chosen each year by evaluating multiple criteria in a matrix. ○ Future plans: investigating options for point-of-sale requirements or other trigger (e.g. age of home/lateral); have had early discussions with realtor association regarding property disclosure forms.	Reducing overflows, system capacity and, later, in response to WSER (legislation for Municipal Wastewater Effluent, under the Federal Fisheries Act, enacted 2012).	Uptake significantly increased over the years, likely due to improvements in customer service and communication. Employed enforcement measure of shutting off water once (for a cross-connection, and only after years of discussion). Incident received a lot of media, and has likely led to increased uptake, particularly with ICI customers.	Funding: Utility operating budget	Halifax Regional Municipality Charter, sections 13, 61, 64, 79 Patricia Isnor / 902-483-8187
Regional Municipality of York, ON **Population 1.11 million** Separated system	Comprehensive I&I Strategy and Pilot Projects	In 2014, York Region was planning to conduct pilot studies to test effectiveness of specific rehabilitation techniques and methods, then will determine best management approaches moving forward. ○ Municipal programs: some local programs funded by developers in exchange for allocation of new units of development. In 2018, York Region launched a private-side I&I reduction pilot project in partnership with the local municipalities in two study areas. 63% of residents in the pilot study areas engaged with the Region and its representatives, resulting in 42% of residents signing up to participate in property inspections.	Sanitary sewers located on private properties make up more than 50% of York Region wastewater conveyance system in length. Experience in other municipalities has indicated that I&I sources on the private side can contribute 60%-80% of I&I in a wastewater system.	With information gathered in the pilot study, the Region is committed to support local municipalities in the development and implementation of new private-side programs, through a toolkit consisting of: • Standardized materials and messaging across the Region as education and outreach is critical to drive citizen participation • Program models that can be customized for program planning and initiation • Analysis of results through Region's flow monitoring program • Administrative processes and applications	2014 Budget: Estimated private side remediation program budget of $10 million for Phase 2 (inspecting and re-lining ~3,000 private sewer laterals)	2021 York Region Inflow and Infiltration Reduction Strategy Update
USA						
City of Lakeport, CA **Population 4,900** Separated system	Regulatory Approach: Inspection with Permits and Certificate Program	**Requirement for Certificate with Permit**: Ordinance requires private laterals be cleaned, inspected and tested for I&I by the owner at predetermined events – including when applying for a building or plumbing permit. 25-year certificate for watertight laterals, 10-year certificate for CCTV tested. Option to fine a noncompliance fee.	Reducing overflows to fresh water lake. No EPA order.			Ordinance 872 (2008)
City of Glendale, MO **Population 6,000**	Targeted Approach	**Refuse Bill (insurance program)** – added $7 to quarterly bill and saved in a separate fund for a Sewer Lateral Repair Program (1997). ○ Assistance for residents who have to pay for sanitary sewer lateral repairs between its connection with the sewer main and the house connection.	Regional: St Louis City began a sewer lateral insurance program in 1989. Most municipalities in the County followed, including Glendale	2,600 households and average around 90 applications per year, of that about 80% require repair.	Funding: Refuse bill every three months Property owner's annual contribution	tjones@glendalemo.org Sewer Lateral Repair

Jurisdiction	Program Approach	Program Description	Primary Driver(s) for Program	Program Impacts	Program Costs and Source of Funding	References
Separated system		○ The program <u>does not pay</u> for the cost of sewer cleaning to remove tree roots or buildups, rather that is the responsibility of the property owner/resident. ○ The program <u>pays</u> for point-of-break repairs, which means that the portion of the pipe that is defective is repaired. ○ Residents will be reimbursed up to $3000/year. If a problem is found, the CCTV video inspection will be paid for by the program.	in 1997. Note: The EPA issued orders to the regional sewer agency in 1994 due to CSOs and in 2007 due to continued overflows and basement backups; though it's unclear the level of contribution from Glendale.		is $50/year that is billed quarterly in increments on the City's sanitation bill ($12.50/quarter). $112,500 is collected annually as part of this program.	<u>Program</u>
City of Brentwood, MO **Population 8,000** Combined & separated systems	Incentive Approach	**<u>Sewer Lateral Repair Program:</u>** effective January 1, 2020 ○ For non-emergency repairs, property owner is responsible to obtain a minimum of three quotes ○ Intended to assist property owners who have continuous sewer blockages and no sanitary sewer service. Not to be used to satisfy a home sale contingency. Repair cost limit up to $3,500 remains – repairs above the $3,500 are the responsibility of the owner. **<u>(Program no longer running): Reimbursement to 100% (insurance program)</u>** – when a blockage or sinkhole is noticed by the property owner, the owner must call the Sewer Hotline, the City sends a company out to check the problem and if there is a problem, the City will pay to have it fixed. Residents are reimbursed up to 100%.	US EPA issued a CSO control policy in 1994 (applies to combined areas only – includes St Louis City). St Louis City began a sewer lateral insurance program in 1989. Most municipalities in the County followed, including Brentwood in 1997. In 2007, EPA issued MSD (the regional sewer agency) an Administrative Order due to continued overflows and basement backups.		2014 Information: Funding: $120,000 is collected annually as part of this program. Property owner's annual contribution is $28/year. In 2010, voters agreed to raise this to $50/year.	<u>Sewer Lateral Repair Program</u>
City of Golden Valley, MN **Population 21,600** Program for separated system	Incentive Approach	**<u>[No longer running, not able to find reason why] Grant Program:</u>** ○ 2008 - Grants for lesser of $1,000 or 50% of the actual cost for separation. ○ 2009 - Grant for lesser of $2,000 or 50% of the actual repair cost. ○ Both programs ended May 2009 (no more funds).	City had been receiving surcharges from MCES, but since implementation of Point-of-Sale Program, the City is no longer receiving the surcharges.	57% properties have reached compliance More than 90% of the homes that are inspected need some kind of repair. Staff with the City review the real estate listings to ensure that all the homes for sale, have been inspected. Real estate agents and title companies now know about the program and support the City in making residents aware of the requirements. Review by outside consultant concluded that efforts in Golden Valley were successful in reducing the 10-year peak hour flow by 24%.	Costs: 2008 – 6 residents received a total of $2,982.75 from the foundation drain separation program. 2009 – 56 residents received a total of $82,745.38 from the service lateral grant program. Funding: Incentive funds from regional authority (MCES) grant program. Property owners pay required inspection fees: $250 residential, $750 non-residential.	City Code Chapter 3, Section 3.31
	Regulatory Approach	**<u>Point-of-Sale Program (Jan 2007):</u>** ○ Requires all properties to pass a sanitary sewer inspection and obtain a certificate before selling, advertising for sale, or transferring title. ○ Failure to comply may result in monthly utility bill charges ($500-$1,000) and possible loss of water service.				
	Targeted Approach	**<u>Private Property Inspections</u>** ○ Free inspections are conducted when the City is doing work in the area, and then homeowners can choose if they want to do the repairs at that time, or not.				
City of McMinnville, OR **Population 34,000** Program for separated system	Incentive Approach	Programs have not been updated since 2014 – currently looking into whether they should increase 10% up to amount, and the fine of $50/month. **<u>Monetary Incentive</u>**: part of the private sewer lateral replacement program. ○ Reimbursed 10% of their construction cost up to a maximum of $250. ○ To be eligible, property owners must construct an acceptable lateral replacement within the 90-day grace period. **<u>Interest Program</u>**: property owners who may have trouble finding financial assistance through banks or other lending agencies. ○ Interest shall accrue on the balance due at the prime interest rate plus 3.5%. It is important to note that this is not a "low interest" loan.	US EPA: City has been directed by EPA and the Oregon Department of Environmental Quality (DEQ) to control the overflow of untreated sewage into the Yamhill River, which occurs frequently during the rainy season.	In 2019, there was about 300 laterals inspections with approx. 100/150 of those needing repair.	Property owner pays to replace defective private sewer laterals.	Josh Adelman Josh.Adelman@mcminnvilleoregon.gov
	Regulatory Approach	**<u>Repair Enforcement with Financial Penalty</u>** ○ Problem laterals are identified by the City and property owners informed of responsibilities by letter. 90 days to repair/replace lateral or fine of $50/month. ○ Non-compliance accumulates and lien is placed on the property. ○ Properties will not be randomly selected for evaluation. The properties evaluated will usually be part of a comprehensive pipeline repair project where City pipes are				

Jurisdiction	Program Approach	Program Description	Primary Driver(s) for Program	Program Impacts	Program Costs and Source of Funding	References
		repaired first.				
City of Westlake, OH **Population 34,000** Program for separated system	Education	Information brochure providing information on sanitary sewer back-ups, and storm water infiltration.	After a major rain event in 2008, Engineering Department created a Mitigating Wet or Flood Basements Brochure			Mitigating Wet or Flooded Basement Brochure
	Targeted Approach	**Rehabilitation Program** undertaken in 8 basins. ○ Started in 1992 by only public side rehab, but still had flooding. Decided private side must also be rehabilitated. ○ 2014: completed 8 basins in total since 1992.	Flooding of streets and yards during intense rainfall events and surcharging of sanitary sewers within basements. Westlake has joint treatment with City of Rocky River, which received an Administrative Order from the EPA in 2009; unclear level of contribution from Westlake.	1992 – inspected, re-grouted and fixed as needed private laterals where dye in sewer. 2001 – re-lined private laterals. I&I was 80% reduced in the area. 2004 – re-lined private laterals, as well as manhole sealing and tight seal at mainline/ lateral interface. I&I was 95% reduced in area. Complaints reduced or non-existent. 2007 – similar to above. Complaints reduced, no flow data yet available. 2014 – 816 homes inspected; 417 repaired.	Costs: 1992 – $338,000 and only $5,000 under property owner responsibility. Funding: 1992 - property owners paid private portion. 2001-2007 - City decided to fund all private property costs in future projects because the private portion was estimated to be approx 1.5% of the project cost. Total Costs (up to 2014): $2.3 million (3.3 million "total")	
City of Eagan, MN **Population 67,400** Program for separated system	Incentive Approach	**Inspection Program:** ○ City pays 50% of required repairs. ○ Property owner may elect to have all or part of their portion levied as a special assessment against the property over 5 years at 4% interest. ○ Utility staff inspect for I&I sources when installing a water meter.	Regional surcharges from MCES if peak flows are not reduced (see MCES below). Focus is on disconnecting improperly connected sump pumps and drainage systems. A significant rainfall event resulted in excessive peak flow allocations to the regional collection system and treatment plant owned and operated by MCES. The addition of I&I into the sanitary sewer system was straining the City's equipment and infrastructure, resulting in higher sewer rates.	The City was able to inspect 99% of the private properties in less than five years. The inspections found that 5% of local properties had one or more factors contributing I&I to the sanitary sewer system: 850 repairs were made. Since the inception of the program, the City has seen a decrease of nearly 10% in wastewater being sent to its wastewater treatment facility - saving hundreds of thousands of dollars each year. The City also reduced sewer rates for its customers.	The City pays for inspections done by the company the City contracted with. If a homeowner chooses to have a plumber of their choice do the inspection they are responsible for the cost of the inspection.	City Code Section 3.40 to add Subdivision 10 City of Eagan Program Documents
	Regulatory Approach	**Monthly Fines on Utility Bills:** ○ Fines for non-compliance - a utility surcharge of $150 per month (single family residential) or $500 per month (non-single family residential). ○ City inspects properties in identified neighbourhoods. ○ Required inspections followed by Corrective Work Order / Compliance Certificate.				
	Education	**Public I&I Education Program:** ○ Education program before starting the private inspections. ○ Included newsletter articles, public meetings and spots on ETV (Eagan's TV stations).				
City of Berkeley, CA **Population 103,000** Program for separated system	Regulatory Approach	**Sewer Lateral Certificate** - prior to selling a property – including condominiums and other developments with shared laterals – are required to obtain a Sewer Lateral Certificate (SLC) under the following conditions: 1. By close of escrow for the transfer or sale of property (with some exceptions), unless a 6-month extension is granted prior to closing; OR 2. When obtaining a Building Permit for construction or remodel value over $60,000; OR 3. When the City finds that the private sewer lateral may be a public nuisance; OR 4. When a property owner elects to repair or replace their private sewer lateral. *In 2007, 250 properties had closed escrow without obtaining a Sewer Lateral Certificate (SLC). Subsequently, the property owners were issued a Notice of Violation and corrective action is required to fulfill the requirements of BMC 17.24. By end of 2007, 53% of these complied. Enforcement proceeding with remainder.*	US EPA order to East Bay MUD. It is estimated that half of the water that enters the City's sewer during wet weather comes from private property sewer lines, downspouts and yard area drains. Bylaw is for protecting the water quality of creeks, watersheds and the San Francisco Bay.	First year (Oct 2006 – Oct 2007): 1,251 applicants. 84% of properties issued certificates upon submittal and remaining issued deficiency notices. ○ 65% property transfer trigger ○ 14% major renovation trigger ○ 21% voluntary or unidentified After 1st year 80% of laterals were out of compliance. At current rate, will take 30 years to complete all work. .	As of January 1, 2022, the fee for private sewer lateral inspections will be $190. As of January 1, 2022, the fee for a private sewer lateral certificate will be collected in the amount of $150 as authorized by City Council Resolution 63, 262-N.S. The City offers a loan program to assist Berkeley low-income property owners to comply with BMC 17.24 requirements for private sewer laterals – this loan programs comes with several conditions	Berkeley Municipal Code, Chapter 17.24
City of Costa	Incentive	**No longer running: Sewer Lateral Assistance Program (up to 2017)**	The program was changed from the	Between 60-75 applications per year since	$150,000 per year in grants; $50,000	Resolution No.

Jurisdiction	Program Approach	Program Description	Primary Driver(s) for Program	Program Impacts	Program Costs and Source of Funding	References
Mesa, CA **Population 116,500** Program for separated system	Approach	Rebate 50% up to $1,250 for inspection, repair or replacement of lateral. *Recommendations* o Public Outreach Program was successful o Public readily gave permission for entry o Lateral renewal program was cost effective o Proposed to expand program to all 500 critical basins with excessive RDII 2014: SLAP program is still in place **New since 2017: Sewer Inspection Rebate Program:** The Costa Mesa Sanitary District (CMSD) is offering rebates to eligible residents who perform a closed-circuit television (CCTV) video of their sewer lateral or install a clean-out. Homeowners may participate every five years and are only eligible for one rebate payment (CCTV or cleanout installation). CCTV from a ground level clean-out to CMSD main = up to $200.00 CCTV from a roof vent or toilet flange to CMSD main = up to $250.00 Installation of a ground level clean-out (requires permit) = up to $500.00	SLAP to the SIRP because SLAP was retroactive, and SIRP is proactive which supports property owners in doing a CCTV on their laterals every 5 years. To prevent sewer backups and spills. "Sewer spills cause very expensive damage to the interior of a house and the environment, particularly the beaches."	2018.	per year for staff costs No new information on project costs since 2014 report.	2007-742
City of Naperville, IL **Population 147,500** Program for separated system	Incentive Approach	**Sanitary Sewer Backflow Prevention Device Program:** Allows residents and business property owners to install the backflow prevention device of their choice, with the City reimbursing 50% of the cost.	Heavy rainfall events, and storm water causing backups in basement dwellings and businesses.	After significant rain event in 2017, approximately 80% of houses took advantage of the program.	Approximately $20,000 - $50,000 per year.	Chris Myers 630 420 6682
	Targeted Approach	**Targeted Program:** o Private lateral rehabilitation in high priority sewer basins (10 targeted areas). o Areas are selected by the following criteria: 1. Customer service calls; 2. Rain events; 3. Flow monitoring; and 4. Maintenance schedule.	Capacity: Flood situations force lids off of manholes leading to the combining of storm and sanitary flows, and to treatment plant being over capacity.		$2 million for sewer rehabilitation $4 million for the entire program Capital Budget	
City of Tacoma, WA **Population 212,000** Separated system	Incentive Approach	**Residential Sewer Conservation Loan:** The first of its kind Washington, covers up to 90 percent of side sewer repair or replacement costs. The loan features an interest rate at two percent below the prime rate (with a min of 4%) on loan amounts between $1,000 and $10,000. The loan is secured through a security interest (lien) on the project property. Side sewer repair or replacement must be for an existing structure. Applicants must apply for the loan before the side sewer replacement or repair is complete. Late fees waived and payment deferment plans have been made available during the COVID-19 pandemic.	Environmental compliance Effort to prevent back up into the sanitary systems. Opportunity to switch from septic to sewer when appropriate.		$500,000 in 2001 which was sufficient funds – currently the program is very sustainable with those receiving loans being required to begin payback within a month (and up to 10 years).	Stephanie Seivert sseivert@cityoftacoma.org Tacoma Municipal Code Chapter 12.08.720
	Regulatory Requirement for Education	**Required Education Program** Starting in 2010, real estate professionals are required to provide a side sewer educational flyer to buyers and sellers they are representing prior to the closing of a property. The City also provides the flyer to all permit applicants. The flyer recommends property owners locate and determine the condition of a side sewer.	Proactive program to complement public side efforts to reduce I&I.	No formal tracking of program impacts. Anecdotal information indicates that in the last few years (2019 and on) more new homeowners are contacting the City to participate in the loan program – coordinator of program(s) wonders if the real estate agents are no longer giving out the flyers. No real way to enforce the program.	Minimal	
City of Santa Barbara, CA **Population 420,000** Program for	Incentive Approach	**No longer running, due to lack of funds: Grant Program:** o $150 for inspection; Up to $2,000 or 50% for repair; permit fees waived o Low-interest loans for those needing financial assistance.	Spill prevention / reduction of sewage spills into storm drains *(no reference to EPA order found)*. Recent (2012) settlement with Channel keepers re: Clean Water Act will require the City to spend an additional $4.5 million over the next	Inspections: 1306 (residential), 313 (commercial), 29 (condo) from Jan 2007 to Feb 2010 o 930 residential laterals repaired over same period o 983 certificates issued over same period	Far more expensive than anticipated (> $600K in first year – 3 times more than estimated). Since January 2007, total program cost of $2,470,000: o < 1% ($7,600) for lateral	Municipal Code Chapter 14.46
	Regulatory Approach	**Not currently running, due to COVID-19: Enforcement Program:** o City identifies problem laterals & provides notices requiring repair. o City notifies property owner & required to fix or $150 penalty & referral to attorney's				

Jurisdiction	Program Approach	Program Description	Primary Driver(s) for Program	Program Impacts	Program Costs and Source of Funding	References
separated system		○ office for enforcement. ○ Commercial properties required to inspect every 10 years.	5 years to improve its sewage system, reduce sewage spills; with a focus on those with highest risk of leaking into storm drains.	Over 95% have reach compliance	○ inspections only ○ 73% ($1,800,000) for lateral repair incentives ○ 11% ($270,000) for waived permit fees charged to our section. Does not include any additional costs of resources, marketing or legal fees. Capital Program Funding.	
	Education	**Certificate Program:** ○ Zoning Information Report (ZIR) at time of sale indicates if Certificate obtained & advises buyer of responsibility.				
		Sewer Lateral Inspection Program: ○ Property owners are responsible for maintaining the sewer lateral, or sewer pipe, that connects their house or building to the public sewer main. ○ Required to hire a City Certified CCTV Inspector ○ May receive notice from the City to indicate that requirement of inspection. Trigger for this include: defect identified through City sewer line, a Private Lateral Sewer Discharge originated on the property, application for a construction building permit.	The goal of the SLIP in 2022 is to eliminate private sewer spills in the city.	Program just started in July 2021 – so far about 30 homes have participated.		Sewer Lateral Inspection Program
City of Austin, TX **Population 950,800** Program for separated system	Incentive Approach & Regulatory Approach	**Financing (loan) Program** available with a minimum amount of $1000, and a maximum amount of $3000. ○ Available to homeowners of detached, single family dwellings or owner-occupied duplex with an active Utility account. ○ Prior to construction, the lateral must have been inspected – final installation must be inspected and approved by the Utility. ○ Utility buys down interest rate on the loan. ○ The Housing & Planning Department provides free replacement or repair of these lines for eligible Austin Water customers of a single-family home or duplex whose household income is 100% or less than the area Median Family Income (MFI). **Fines for Non-Compliance:** ○ City identifies with inspection and sends letter requiring fix within 120 days. Fine up to $500 per offense (each day non-compliant is a separate offence).	US EPA Administrative Order requiring City to take measures to prevent sewage overflows (1999). Also cite desire to reduce costs.	Private Lateral Grant Program started in 2013 and to date there have been just over 200 private lateral replacements completed in this grant program. No monitoring but have noticed an anecdotal change in areas where City grant program has been implemented.	Annual cost for the Private Lateral Grant Program is about $180,000 with total costs to date approximately at $1,000,000.	Ordinance No. 20070125-007 Greg Kirton
Milwaukee Metropolitan Sewerage District (MMSD), WI **Population 1.1 million** Primarily separated system (~6% combined)	Regional Targets and Required Compliance Plans Approach	**Regional I&I Targets (Limits)** and Community Compliance Requirements: ○ Made long-term peak wet weather management plan that sets standards for expected flows at each "metershed", then identifies if standard is exceeded, and requires offending municipality to create a plan that will bring it into compliance. Within 1.5 years, 8 municipalities had been notified of non-compliance and were creating flow reduction plans. ○ In 1998 MMSD adopted rules that municipalities must develop and implement an I&I management plan; and must enforce prohibited connection ordinances. ○ Region created a Policy Document for I&I funds clearly establishing the rational for private property I&I work, and what is eligible for funding. ○ Region has also aggressively pursued education program with respect to basement backups, including website and video.	Historically has had settlement with EPA/DNR for SSOs (early 2000s). Created a 2010 Facility Plan, then later a 2020 Facility Plan to reduce SSOs. Federal grant provided for private property efforts. Severe storms (2008 through to 2010) causing thousands of basement backups resulted in MMSD announcing a regional Private Property I/! (PPII) reduction program and developed a comprehensive PPII policy.		Program was authorized with an expected total budget through 2020 of $62 million.	MMSD 2020 Facilities Plan Private Property I&I Policy Documents and Work Plan
King County, WA **Population 1.5 million** Separated systems except in some parts of Seattle	Agency led Inspection and Rehabilitation Projects	**Rehabilitation Projects where Cost Effective**: Started Regional I&I Control Program in 2000 – now in place 22 years. ○ Completed several pilot projects and assessed cost effectiveness ○ Evaluate projects on a case-by-case basis to determine cost effectiveness ○ Developed standards, guidelines and policies for lateral inspection and remediation ○ Found that basins with I&I less than 3 gallons per minute per property were not good candidates (too many properties would have to be rehabilitated to achieve target reductions In March 2022, King County published several updates and resources on their website, including a Side Sewer Best Management Practices (BMP) Toolkit, a Know Your Sewer System card, and 2 technical reports: Final Regional Best Management Practices	King County and City of Seattle agreement to upgrade combined sewers under settlement with US EPA in 2013.	Data collected indicates large percentage of I&I originates from private property. Recently completed larger scale I&I control project (Skyway) that tested assumptions from the smaller pilot projects. Found the I&I reductions were much lower than predicted, but still significant.	6-year control study of 10 pilot projects cost $41 million. Combined funding from King County and local agencies.	Executive's Recommended Regional I&I Control Program (2005) Task 600 Private Side Sewer Program Identification and Relevance

Jurisdiction	Program Approach	Program Description	Primary Driver(s) for Program	Program Impacts	Program Costs and Source of Funding	References
		Development and Final Inspector Training and Certification Program Development.				to the King County Wastewater Service Area
Miami-Dade County, FL **Population 2.4 million** Program for separated system	Regulatory Approach & Targeted Approach	**Enforcement Program:** ○ Identified private property defects through smoke testing and property owners were required to make repairs to their laterals as required by Miami Dade County Ordinance. ○ The County simply the property owners and they made repairs to the system. ○ Subsequent re-smokes of the area verified if the repairs were completed. *Insurance Issues: minor property damages usually the result of testing and or repair crew equipment that have inadvertently encroached on private property and damaged easement and ROW areas.* **Comprehensive Lateral Pilot Program (began in 2004)**: $13 million dollar project designed to determine if a private lateral testing and inspection program was a viable solution to the reduction of peak flow. Update from 2006: • Public outreach was conducted to receive permission from property owners – approximately 96% agreed to have their sewer inspected (about 70% of total responses) • Private side laterals which failed were televised and smoke tested to prove to the property owner that they were defective Update from 2022: • Program is no longer running, as the County has no way to enforce the program and the political will to fund it is not there.	Series of US EPA Consent Decrees (1994/5 and 2013) in relation to sewer spills. 2013 Consent Decree requires substantial repair of 3 WTPs and sewer system at an estimated cost of $1.6 billion (Miami-Dade County Clean Water Act Settlement).	Enforcement Program was 85% effective. Average of over 700 lateral replacements per year. Average daily flow: 116 MGD's in total reduction (over a 14 year period). CLIP: Inspected 6,749 laterals. 85% effective in repairing laterals (repaired / replaced over 1200 laterals). Estimated cost to pump and treat $8,645/GPM. Estimated cost for mainline inspection/repair $362/GPM (23 times more cost-effective than pump and treat). Estimated cost for lateral inspection/repair $2,308/GPM (about 3.7 times more cost effective than pump and treat). Total Program $1,011/GPM removed.	Both programs funded by combination of: Bond Funds, Capital Revenue Funds, and O&M Funds. Overall cost of the enforcement program is now over $400 million dollars. Cost of the 43 basin CLIP program approx. $13 million: ○ $4m - mainline inspection/ repair ○ $4m - lateral inspection ○ $4.5m - lateral repair ○ $0.5m - admin costs NOTE: lateral inspection / repair includes public side upper lateral Funding: $1 million dollar grant for the implementation of the CLIP program.	
Metropolitan Council of Environmental Services (MCES), MN (Twin Cities) **Population 3 million +** Program for separated system	Regional Targets and Surcharge Approach	**Regional Surcharge**: MCES continuously monitors volumes of wastewater from municipal systems, and requires the municipalities to reduce peak flows to the regional collection system, or charges them. ○ 1993 – 2003 MCES provided grants to communities to reduce I&I, but not sufficient ○ In 2006 instituted surcharge for clear water; communities that have I&I reduction plans can opt out of the surcharge in order to make investments in I&I reduction (must match or exceed surcharge) ○ In 2014, a significant wet period followed by a storm, resulted in 46 communities exceeding I&I goal peak flows, resulting in each having to develop a work plan that required completion in 4 years. ○ MCES is now working to promote more efforts by communities on private property I&I ○ Eligible private property I&I mitigation activities included sewer lateral repair or replacement and / or disconnection of foundation drains. Property owners can apply for reimbursement by MCES of actual costs (up to $2,000) for qualifying repairs of sewer laterals.	History of working to improve water quality in the Mississippi has led to implementation of more proactive approaches. Capacity concerns in certain locations (e.g. Golden Valley). Also SSOs, private property spills, using up capacity for future growth.		I&I reduction is funded by communities with amounts equivalent or exceeding avoided surcharges. 2013 received $1,000,000 in grants for local I&I reduction programs. In recent years, grant funding administered by MCES for private property I&I mitigation activities has been limited to $900,000 per year.	Water Resources Management Policy Plan

Appendix B – Bylaw Examples (Canadian)

Responsibility of Owner

Sample Bylaw, Metro Vancouver (2011 Report, Appendix H):

PART 2 – (6) to (9) – Required Maintenance Standard

Town of Fort Erie Bylaw 68-06:

3.8.2 Every owner shall maintain their private sewer lateral or private sewage collection system and private drainage lateral or private drainage or storm water management systems, including appurtenances connected thereto, in good working order and condition, and adequately protected from blockage and freezing. Private sewer laterals and private sewage collection systems shall be maintained free from drainage and storm water inflow and infiltration.

Halifax Water Rules and Regulations for Water, Wastewater and Stormwater Services:

64.(1) The Commission may from time to time undertake testing or inspections to identify and locate connections that convey stormwater into a wastewater facility.
(2) No person shall, without the prior written approval of the Commission connect, cause to be connected, or allow to remain connected to a wastewater facility or plumbing installation, any piping fixtures, sump pumps, downspouts, fittings appliances or like equipment or device in a manner which allows or may allow stormwater to ingress or flow into a wastewater facility.
(3) The Commission may direct a person to discharge stormwater to a stormwater system, a surface area or watercourse.
(6) The Commission may determine, in its discretion, that this Section does not apply to existing premises connected to an existing combined sewer system or to new premises intended to be connected to a combined sewer system, provided that those premises are not serviced or able to be serviced by a separate stormwater system.

Cleanouts Required

Sample Bylaw, Metro Vancouver (2011 Report, Appendix H):

PART 2 – (10) to (12) – Cleanouts Required [optional]

Town of Fort Erie Bylaw 68-06:

3.8.4 Inspection tees shall be installed in all private sewer laterals at the expense of the Owner as specified in Appendix "1" attached hereto, and shall be maintained in good order and accessible at all times, and free from drainage water inflow and ground water infiltration.

Entry and Testing

Sample Bylaw, Metro Vancouver (2011 Report, Appendix H):

PART 2 – (14) to (17) – Entry and Testing by City

City of Kingston Sewer bylaw 2008-192:

14.1 Inspection powers

The Operating Authority or any person designated by it as inspector for purposes of this by-law may, at reasonable times enter onto any land on which the City supplies sewer services for the following purposes:

a) to inspect, repair, alter, or disconnect the sewer lateral or storm sewer lateral, machinery, equipment and other works used to supply sewer services to the building or land;

b) to inspect, install, repair, replace or alter any related metering equipment;

c) to inspect the discharge of any matter into the sewage system of the City or into any other sewage system the contents of which ultimately empty into the municipal sewage system and may conduct tests, measure flow and take samples for this purpose; or

d) to investigate or determine if this by-law, an order, or condition to any permit or agreement is being complied with.

14.4 Entry on land – notice requirements

Whenever an inspector exercises a power of entry pursuant to this By-law, the inspector shall:

a) provide reasonable notice of the proposed entry to the occupier of the land by personal service or prepaid mail or by posting the notice on the land in a conspicuous place for three consecutive days prior to entry;

b) where the proposed entry is an inspection to determine compliance with this By-law the inspector must provide reasonable notice by means of personal service only;

c) in so far as is practicable, restore the land to its original condition where any damage is caused by the inspection; and

d) provide compensation for any damage caused and not remedied.

Halifax Water Rules and Regulations for Water, Wastewater and Stormwater Services:

61.(3) The Commission may require a wastewater or stormwater service connection to be inspected and brought into compliance with these regulations.

64.(1) The Commission may from time to time undertake testing or inspections to identify and locate connections that convey stormwater into a wastewater facility.

Town of Fort Erie Bylaw 68-06:

3.8.7 Every Owner shall, at all reasonable times and upon reasonable notice given and request made, allow and provide access to their building or premises to the Engineer for the purpose of conducting a compliance inspection and taking corrective action, and/or to carry out work, all as permitted under this Schedule, the Ontario Building Code, or the Municipal Act 2001.

3.9.1 The Engineer and/or Chief Building Official or any person duly authorized by the Corporation shall be allowed access to a building or premises, at all reasonable times, and upon reasonable notice given and request made to the Owner, Operator or Customer, for the purpose of inspecting, maintaining, repairing, disconnecting or reinstalling a sewer service connection or drainage service connection as permitted by this Schedule or by the Ontario Building Code or by the Municipal Act 2001.

City of Brantford Sewer System Regulation – Use:

ARTICLE 11 POWER OF ENTRY AND INSPECTION

11.1 The City may enter upon any part of a property at any reasonable time, to inspect the discharge of any substance into the sewage works or storm sewers and may conduct tests and take samples of the discharge.

11.2 The City's power of entry described in subsection 11.1 may be exercised by an employee, officer or agent of the City, including a municipal by-law enforcement officer.

11.5 When entering a property in accordance with articles 11 and 12 of this by-law the person exercising the power of entry shall provide identification to any person requesting identification during the course of the inspection and,

a) may be accompanied by a person or persons under his or her direction; and

b) shall not enter or remain in any room or place actually used as a dwelling unless one of the conditions set out in section 437 of the Municipal Act, 2001 are met.

11.6 When entering a property in accordance with articles 11 and 12 of this by-law the exercise of such powers shall be limited to reasonable times, unless an emergency situation requires otherwise.

11.7 For the purposes of an inspection to determine compliance with this by-law or any order issued under this by-law or to otherwise enforce this by-law a municipal by-law enforcement officer may,

a) access any drain pipe, interceptor, maintenance access hole, catch-basin or other discharge point connecting, directly or indirectly, to the sewage works or storm sewers, including by making or requiring necessary excavations;

b) make and record observations, such as by taking photographs, notes, video recordings and sound recordings;

c) require the production for inspection of documents or things relevant to the inspection;

d) require information from any person concerning a matter related to the inspection;

e) alone or in conjunction with a person possessing special or expert knowledge make examinations or take tests, samples or photographs necessary for the purposes of the inspection.

f) inspect and remove documents or things relevant to the inspection for the purpose of making copies or extracts; and

g) do such other things that are reasonably necessary for an enforcement officer to effectively carry out the inspection.

11.8 A demand by a municipal by-law enforcement officer to respond to reasonable inquiries under subsection 11.7 (e) or to produce documents under subsection 11.7 (f) may be made by telephone, letter or e-mail and such demand shall be deemed to be made in the course of an inspection.

11.9 No person shall refuse or neglect to give, produce or deliver any access, information, document or other thing that is requested by a municipal by-law enforcement officer carrying out an inspection.

11.10 No person shall hinder or obstruct or attempt to hinder or obstruct the City, its municipal by-law enforcement officers, employees or agents from carrying out any powers or duties under this by-law.

Require Fix of Defect

Sample Bylaw, Metro Vancouver (2011 Report, Appendix H):

PART 3 – (18) to (20) – Certificate Required – Identified Defect

City of Kingston Sewer bylaw 2008-192:

3.2 Maintenance of sewer lateral – Owner

Every Owner of a property to which sewer service is provided shall be responsible for the maintenance, repair, and replacement of the sewer lateral from the building to the property line. Any and all structural defects of a sewer lateral shall be repaired by the Owner of the property being serviced. Should the City become aware of any such structural defect, and upon written notification to the Owner, the said structural defect is not repaired within thirty (30) days of the date of the notification or within such time as the Operating Authority may deem necessary, then the City may turn off the municipal water supply to the property. If the City is ordered to restore the water supply, then the City may repair the structural defect in the sewer lateral pipe at the Owners expense. In so doing the City of Kingston shall only reinstate the property to a safe condition and all final restoration shall be the Owners responsibility. The City of Kingston shall not be held responsible for any damages to the Owners property arising from such work such as damage to root systems or other landscaping features located along the sewer lateral. If flushing or rodding of a sewer lateral is required to remove an obstruction located anywhere between the building and the sewer lateral stub, the Owner or occupier shall be solely responsible for the cost of removing the obstruction.

Town of Fort Erie Bylaw 68-06:

3.8.5 Should a leakage occur from a private sewer lateral or private sewage collection system, or from a sewage holding tank, or from a septic tank system or any other private sewage treatment system; the Owner shall be bound to take corrective action and to complete the repairs of the said leakage, at the Owner's expense, within seven (7) calendar days after being duly notified by the Corporation of such leak detected. In the event of non-compliance with this provision by the Owner, the Corporation may at its sole discretion exercised by the Engineer, discontinue the supply of water from the Water Works until the Owner has made the necessary repairs. All repairs are to be inspected and approved by the Chief Building Official prior to backfill.

City of Brantford Sewer System Regulation – Use:

ARTICLE 12 ORDERS

12.1 Where the General Manager has reason to believe that a contravention of this by-law has occurred, the General Manager may issue and serve an order requiring the person who has contravened the by-law or who has caused or permitted the contravention or the owner or occupier of the property on which contravention of the by-law occurred to discontinue the contravening activity.

12.2 Where the General Manager has reason to believe that a contravention of this by-law has occurred, the General Manager may make an order requiring the person who has contravened the by-law or who has caused or permitted the contravention or the owner or occupier of the property on which contravention of the by-law occurred to do work to correct the contravention.

12.3 Where a person is issued an order described under sections 12.1 and 12.2 and in the opinion of the City fails to do a matter or thing required by the order by the date specified in the order, the City may cause the matter or thing set out in the order to be done at the person's expense.

12.4 For the purpose of doing any matter or thing under section 12.3, employees of the City and any contractor, consultant or other person authorized by the City may enter upon the property referred to in the order at any reasonable time.

Require Inspection for Construction, Renovation or New Connection

Sample Bylaw, Metro Vancouver (2011 Report, Appendix H):

PART 3 – (21) to (23) – Certificate Required – Construction, Renovation or New Construction

District of North Vancouver bylaw 6656:

14. Re-Use of Existing Sewer Connections

All building permits of value greater than $150,000 will require a new sewer (sanitary) connection unless:

(a) the existing connection(s) is less than 30 years old;

(b) a current video inspection meeting MMCD or equivalent standards is undertaken by a qualified inspector and provided to the District; and

(c) the video inspection establishes to the satisfaction of the Director that the connection(s) is in good condition with no defects.

City of Surrey bylaw 16611, 2008:

39. When an application for a service connection accompanies a building permit with the construction value greater than $100,000 or where a parcel is being redeveloped, the following shall apply to the service connection and the building sanitary sewer:

(a) if the service connection and building sanitary sewer is less than 30 years old, the owner must provide a video inspection and recommendation for the City to review. The owner shall repair or replace the connection if the City determines that the connection is not adequate for service or has excessive damage;

(b) if either the service connection or the building sanitary sewer is 30 years old or older, a replacement or new service is required;

(c) all no-corrode, asbestos cement or clay service pipes of any age or condition shall be replaced;

(d) any shared service connections and building sanitary sewer shall be replaced; and

(e) all costs associated with the above are the responsibility of the owner.

The General Manager, Engineering may waive part of the above requirements if the General Manager, Engineering deems the cost of the replacement excessive.

Fees, Recovering Costs

Sample Bylaw, Metro Vancouver (2011 Report, Appendix H):

PART 5 – (51) – Fees

Town of Fort Erie Bylaw 68-06:

3.9 Compliance Inspections and Corrective Actions

3.9.2 Any costs incurred by the Corporation in conducting inspections and subsequent reporting or in effecting any corrective action, shall be payable to the Corporation by such Owner, Operator or Customer; and if not paid, the costs shall be added to the tax roll for

the property and collected in the same manner and with the same priority as municipal taxes.

Financial Assistance, Monetary Incentive

Sample Bylaw, Metro Vancouver (2011 Report, Appendix H):

PART 5 – (52) to (63) – Financial Assistance and/or Monetary Incentive for Voluntary Inspection and Repairs

City of Brantford Program (not in the bylaw – text from website):

Private Sanitary Sewer Lateral Replacement Grant Program
This is a financial assistance program for homeowners to help offset costs for the replacement of old sanitary sewer laterals on private property. This incentive program is being offered in the interest of helping homeowners prevent or reduce the occurrence of sewer blockages.

City of Windsor bylaw 4921 (n.b. the owner is responsible for the lateral to the main):

PART B – SEWER CONNECTION REPLACEMENT POLICY
1.REPLACEMENT
The City will provide a sewer replacement rebate for a complete sewer replacement calculated as follows:
1. Where there is a fronting Public Sewer that can be used in a complete sewer replacement, the City will provide a rebate being the lesser of the following:

(i) The amount set out in the City's Schedule of Fees, as amended from time to time. It is the intention of this provision that the City's Schedule of Fees will be the relevant rate,
(ii) Fifty Per Cent (50%) of the total cost of the complete replacement,
(iii) The unit cost (being the total cost divided by the total length) multiplied by the length of the replacement on the public highway.

Enforcement, Penalties

Sample Bylaw, Metro Vancouver (2011 Report, Appendix H):

PART 6 – (64) to (74) – Failure to Comply – Offence and Penalties

Halifax Water Rules and Regulations for Water, Wastewater and Stormwater Services:

Offences
79. Where the Commission believes that a person has contravened any provision of these regulations, it may commence proceedings by issuing a Summary Offence Ticket in accordance with the Nova Scotia Summary Proceedings Act.
Suspension or Refusal of Service
13.(3) In the event of a violation of these Regulations by a person or Customer, including liabilities and obligations owed to the Commission by any Customer under a private contract for services entered into between the Commission and such Customer, the Commission may refuse or immediately suspend service to such Customer, and may continue such refusal or suspension until the violation has been cured.

Town of Fort Erie Bylaw 68-06:

3.9 Compliance Inspections and Corrective Actions

3.9.3 Should any Owner or Operator or Customer of a service connection refuse entry to any authorized officer, inspector, employee or Agent of the Corporation for the purposes of any compliance inspection, maintenance, repair, disconnection or reinstallation and/or other corrective action, under the provisions of this Schedule or the Ontario Building Code, or the Municipal Act, 2001; the Corporation may, at its sole discretion exercised by the Engineer, on the provision of seven (7) calendar days notice, discontinue the supply of water to the Owner or Operator or Customer of the service connection until such required inspection and corrective action or required work has been completed to the satisfaction of the Corporation.

Appendix C – References and Links

All references in Appendix C have been updated in 2022.

Examples of smoke testing notices and procedures for Canadian municipalities:

City of Sarnia: Sanitary sewer smoke testing

City of Thunder Bay: Sewer smoke tests

Regional District of Nanaimo: Sewer Line Smoke Testing

Region of Peel: Sanitary sewer smoke testing

Township of Guelph: Sanitary Sewer Smoke Testing

Canadian references and links:

City of Brandon: 2021 Flood Protection Subsidy Program

City of Brantford: Water, Wastewater and Stormwater Master Servicing Plan Update – 2051 Amendment

City of Brantford: Private Sanitary Sewer Lateral Replacement

City of Cornwall: Sewers and Sewer Laterals

City of Charlottetown: Inflow Reduction Program

City of Halifax: Water By-Law

City of Halifax: Stormwater Inflow & Infiltration

City of Kingston: Grant program

City of Kingston: By-Law NO. 2008-192

City of Moncton: Backwater Valve Incentive Program

City of Windsor: Eeling Program

City of Windsor: By-Law Number 9-2019

Halton Region: Enhanced Basement Flooding Prevention Subsidy Program

Newfoundland & Labrador: Final Report Study on Identification and Characteristics of Sewer Overflows in Newfoundland and Labrador.

Niagara Falls: Avoiding Sewer Backups

Town of Fort Erie: By-Law NO. 68-06

York Region: Inflow / Infiltration Reduction Strategy: Industry Best in Class Review

York Region: Inflow / Infiltration Reduction Strategy

Kesik, T. (2015). Best Practices Guide: Management of inflow and infiltration in new urban developments. Institute for Catastrophic Loss Reduction. Available at: https://www.researchgate.net/publication/280558457_Best_Practices_Guide_Management_of_Inflow_and_Infiltration_in_New_Urban_Developments

Kovacs, P., Guilbault, S., & Sandink, D. (2014). Cities adapt to extreme rainfall; Celebrating local leadership. Institute for Catastrophic Loss Reduction. Avalable at: http://www.iclr.org/images/CITIES_ADAPT_DIGITAL_VERSION.compressed.pdf

Sandink, D. (2013). Urban flooding in Canada; Lot-side risk reduction through voluntary retrofit programs, code interpretation and by-laws. Available at: http://www.iclr.org/images/Urban_Flooding_in_Canada_-_ICLR_-_2013.pdf

US References and Links:

City of Berkeley, CA: Sanitary Sewer Program

City of Costa Mesa, CA: Sewer Inspection Rebate Program

City of Des Peres, MO: Lateral insurance program

City of Florissant, MO: Sewer Lateral Insurance Program

City of Glendale, MO: Sewer Lateral Repair Program

City of Laguna Beach, CA: Staff report

City of Portland, OR: Waste Discharge Permit

City of Portlan, OR: Private Sewer Connections – Article

City of Tacoma, WA: Required realtor package

City of Westlake, OH: Lessons learned during sewer rehabilitation on public and private property

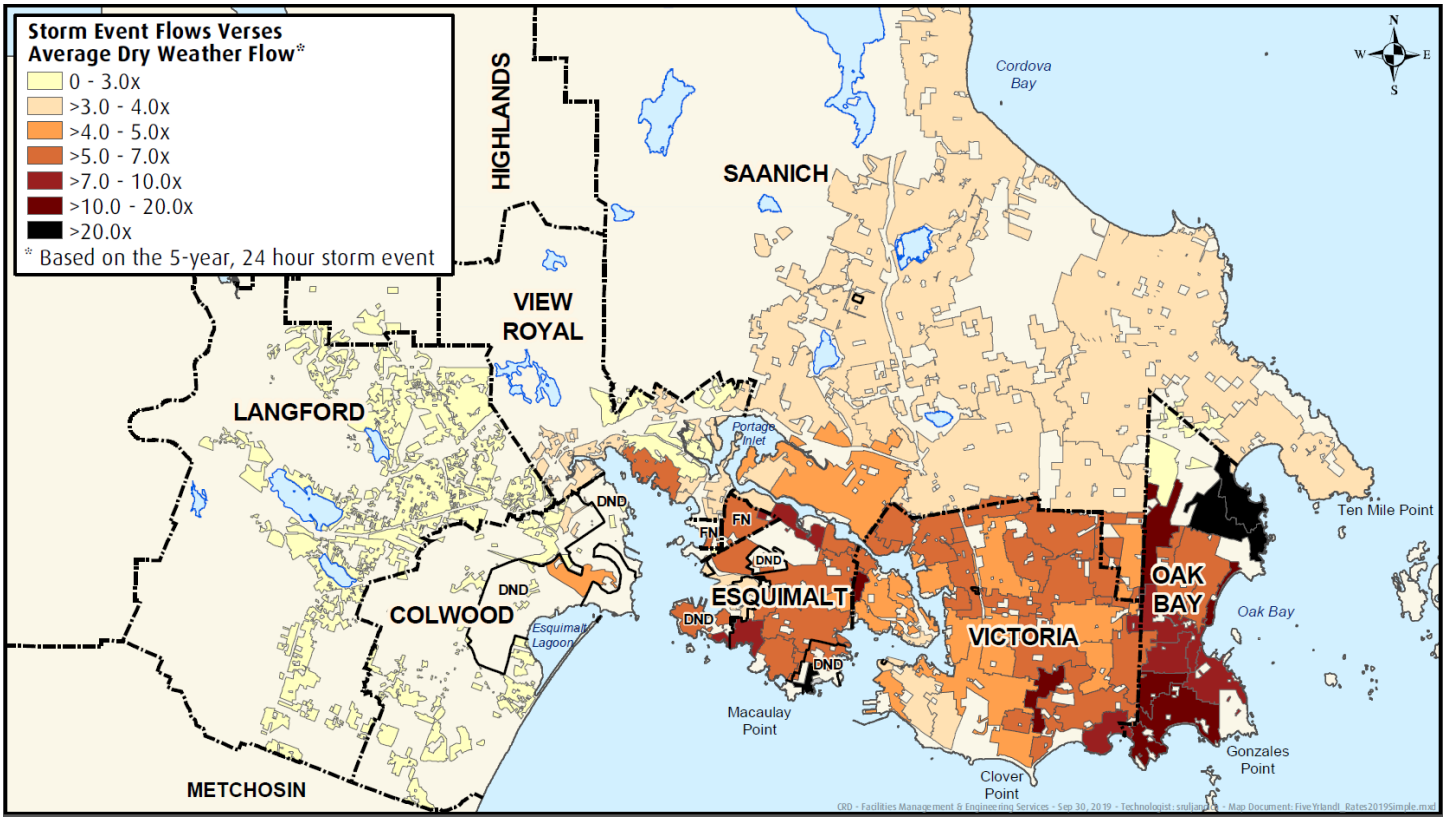
King County, WA: http://www.kingcounty.gov/environment/wastewater/II.aspx

Milwaukee Metropolitan Sewerage District (MMSD): Municipal PP I&I Resource Page

San Francisco Public Utilities Commission, CA: Sewer Lateral Program Financial Plan

APPENDIX B

Inflow and Infiltration Rates Map for the CRD Core Area (2022)



Measured Flows versus Allocated Flows from Bylaw No. 4304

Allocation Point	Allocated Peak Daily Flow (ML/day)	Peak 24 Hr. Flow for a 5-yr Storm	
		ML/day	% of Allocated Capacity
COLWOOD			
Total *Parson's minus Meaford. (During large storm events, the Parson's meter is not reliable and the storm flows are calculated. The Parson's meter is being replaced in late 2022).*	**18.8**	**7.7**	**41%**
ESQUIMALT			
Esquimalt Panhandle	0.48	0.44	91%
Lang Cove PS	5.12	2.95	58%
Dockyard	4.04	3.52	87%
Kinver	1.76	2.20	125%
Pooley Place *(Flows are based on a correlation with an adjacent catchment. Catchment is not suitable for metering due to small size and multiple connections to the CRD system.)*	0.24	0.21	87%
Devonshire	7.40	10.91	147%
Wilson	1.48	1.48	100%
Head	6.72	7.82	116%
Anson	0.97	0.63	65%
Total	**28.36**	**30.16**	**106%**
LANGFORD			
Total *(Meaford)*	**56.48**	**17.01**	**30%**
OAK BAY			
Windsor	11.68	16.24	139%
Humber *(This is catchment has combined sewers. It overflows during most moderate to large storm events but the overflow volumes aren't measured.)*	2.40	4.29	177% [1]
Rutland *(This is catchment has combined sewers. It overflows during most moderate to large storm events but the overflow volumes aren't measured.)*	1.48	5.92	400% [1]
Currie Net *(Flows weren't suitable for comparing to the bylaw allocations prior to the completion of the treatment plant conveyance system upgrades in early 2022. Data from future storm events should be useful for comparing to the allocations.)*	3.88	n/a	>125%
Currie Lift Station	6.48	12.29	190%
Harling Point PS	0.79	1.86	236%
Total *(Flows weren't suitable for comparing to the bylaw allocations prior to the completion of the treatment plant conveyance system upgrades in early 2022. Data from future storm events should be useful for comparing to the allocations.)*	26.48	**n/a**	**>175%**
SAANICH			
Marigold PS	52.76	35.32	67%
City Boundary	23.52	10.97	47%
Harriet	13.08	9.37	72%
Townley	2.44	1.97	81%

Allocation Point	Allocated Peak Daily Flow (ML/day)	Peak 24 Hr. Flow for a 5-yr Storm	
		ML/day	% of Allocated Capacity
Haultain	2.27	1.14	50%
Arbutus	28.31	20.95	74%
Haro - UVic	3.17	0.81	26%
Penrhyn LS	3.73	2.99	80%
Total	**131.56**	**83.52**	**63%**
VICTORIA			
Cecelia	12.57	14.76	117%
Chapman & Gorge *(Flows are based on a correlation with an adjacent catchment. Plans are in place to install a meter)*	1.40	4.98	356%
Selkirk *(Flows are based on a correlation with an adjacent catchment. Plans are in place to install a meter)*	1.11	0.39	35%
Langford - Vic West	0.77	1.32	171%
Hereward	7.65	6.52	85%
Sea Terrace *(The flume surcharges during large storms. Because of this, the Peak 24hr flows are based on a correlation with an adjacent catchment. Options are being explored to address this issue.)*	1.32	1.50	114%
Trent Net	29.32	43.06	147%
Hollywood	2.16	7.43	344%
Olive	92.24	63.00	68%
Clover Net *(The catchment is not suitable for metering due to small size and multiple connections to the CRD system. As a result, the flows are based on a calculation.)*	6.01	7.68	128%
Total	**153.19**	**150.64**	**98%**
VIEW ROYAL			
Craigflower PS *(Flows for this catchment are substantially impacted by the Parson's mag meter, which is being replaced, in 2022, to improve accuracy during storm events.)*	14.16	7.10	50%
Shoreline Trunk	0.55	0.50	91%
Total	**14.16**	**7.1**	**50%**
ESQUIMALT NATION			
Esquimalt Nation *(Flows are calculated. Plans are in place to install a meter in late 2022)*	**0.28**	**0.35**	**126%**
SONGHEES NATION			
Songhees Nation	2.36	2.49	106%
Maplebank	0.04	0.005	13%
Total	**2.52**	**3.09**	**106%**

**Cells highlighted in grey signify metering locations identified for future improvement.*
***The "peak 24-hour flows" were calculated with storm event flow data up to February 2022.*